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RESOURCE RENTS AND ECONOMIC DIVERSIFICATION IN ALBERTA

by

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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "Resource Rents and Economic Diversification in Alberta", submitted by Margaret Caren Insley Forsyth in partial fulfilment of the requirements for the degree of Master of Arts in Economics.

ABSTRACT

Traditional trade theory predicts that, in response to an improvement in its terms of trade, a region will become more specialized in its terms of trade, a region will become more specialized in the production of those commodities in which it has a comparative advantage. Thus, one would expect that, following the rise in the relative price of energy, an energy-rich province such as Alberta would become increasingly specialized in the production and export of energy products. Conversely, one would expect energy-poor provinces to export more of those commodities in which their comparative advantage lies in order to pay for their higher energy import bill.

Canada's federal system of government, which grants natural resource ownership rights to the provincial governments, complicates the country's adjustment to higher energy prices. The governments of energy-rich provinces are able through their powers of taxation to capture a significant portion of the now greatly enhanced resource rents and use this revenue to pursue specific provincial goals. In Alberta's case, the provincial government is of the opinion that it is undesirable for Alberta to become increasingly specialized in resource production. It is feared that such specialization leaves the province vulnerable to external business cycles and to economic stagnation once conventional oil and gas reserves are depleted.

The manner in which Alberta and other energy-rich provinces decide to deal with energy rents has important implications for the structure of, and the efficient allocation of resources within, the provincial and Canadian economies. It is evident that rent captured through taxation of the energy sector enables a provincial government to promote economic diversification by offering fiscal

incentives to factors of production within the province. For oil importing provinces, a decision by Alberta to use resource rents to promote diversification makes their own adjustment to higher energy prices more difficult as Alberta's need for imports from the East is reduced. Furthermore, such actions on the part of Alberta may result in fiscally induced migration from other regions in Canada. That is, factors of production may migrate because of the fiscal or tax advantages provided in the resource-rich jurisdiction. In this case, the allocation of resources will not be efficient as the marginal product of the mobile factor will not be equalized across regions. If the factor supply to Alberta is perfectly elastic, the marginal product of the mobile factor will be lower in Alberta than in other jurisdictions by the extent of the fiscal advantage offered in Alberta. Moreover, to the extent that regional fiscal incentives resemble, in effect, tariffs within the national economy, it may be expected that many of those industries nurtured under regional protection will expire in the long run when fiscal incentives are removed.

The thesis examines in detail the sensitivity of various regional economic aggregates to several possible strategies for rent distribution that could be adopted by provincial authorities compared to the classic staple boom case with no government involvement. Using a simple, multisector, general equilibrium model of a small, open, regional economy, an attempt is made to demonstrate the costs involved to Albertans, and to Canadians generally, of regional government province-building strategies.

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Chapter 1

INTRODUCTION

Since its election to office in 1971, the Alberta Conservative party has maintained the position that Alberta should diversify its industrial base in order to become economically less dependent on the exploitation of non-renewable resources. Premier Peter Lougheed has expressed this sentiment in policy statements numerous times. For example, in a speech made to the Calgary Chamber of Commerce in September of 1974 he stated,

> Since entering public life over nine years ago, my theme has been that the province's economy is too vulnerable, it is too dependent upon the sale of depleting resources, particularly oil and natural gas for its continued prosperity. We have perhaps another decade to diversify our economy to become less dependent ... We must be in a position to be less affected by external factors. If we fail to do so, in my view, we will leave the next generation in Alberta a sad legacy indeed - a lack of economic muscle to sustain our quality of life over the long term.

In the face of dramatic increases in the relative price of energy, the goal of economic diversification has not, however, been easily achievable. Statistics showing gross domestic product at factor cost by industry in Alberta (Alberta, 1980b) indicate that although the manufacturing sector has grown in absolute terms since 1972, its share of provincial gross domestic product has declined. During the same period, the mining sector - including oil and gas - has increased its relative share of provincial gross domestic product.

The barriers facing Alberta in its attempt to industrialize have long been recognized. A small population base, distance from mass markets, and high labour and transportation costs inhibit the development of large scale consumer manufacturing activities. Recognition by government of the problems involved in promoting diversification in Alberta was made evident in the fall of 1979 when

an amendment was made to the Alberta Heritage Savings Trust Fund Act. Originally, the Act stated that the purpose of the investment division of the Heritage Fund was to make investments that would tend to strengthen and diversify the economy of Alberta while providing a reasonable rate of return to the Fund. However, some difficulty was experienced in finding a sufficient volume of investments that would meet both criteria (Collins, 1980). An amendment to the Act was therefore passed altering the second criterion to read "strengthen or diversify" the Alberta economy.

Interest in economic diversification still remains strong, however, within government circles. As provincial treasurer Louis Hyndman has stated,

> It's an instinct in the West that there is going to be a day when the crops fail. (Globe and Mail, September 21, 1981, B19)

The New Democratic Party in Alberta also supports economic diversification. Party leader, Grant Notley, includes as part of the "NDP alternative" the proposal to increase emphasis on, "relatively labour intensive investment, i.e., processing and upgrading of raw resources as opposed to capital intensive projects for export." (Edmonton Journal, October 23, 1980).

The obstacles in the way of broad based industrialization in Alberta have caused the goal of diversification to be associated less with general industrial growth in the province and more with diversification into areas related to the energy industries in which Albertans possess some expertise. As Premier Lougheed has stated,

> We have no dreams of an industrial state. We don't want smokestacks here. We want the best jobs here. We want the brainpower here. We want the upgrading of our resources here. (Financial Post, August 23, 1980, S3)

The government has emphasized the upgrading of raw resources through the development of the petrochemical industry. In addition, high technology

industries, food-processing industries, and steel and metal fabricating are actively promoted as being activities in which Alberta could successfully participate.

A fundamental question relating to economic diversification concerns the role of government. Outwardly, the Conservative Party is philosophically opposed to government intervention in the market place. Clearly, however, the government is extensively involved in the economy through, for example, its regulation of the petroleum industry and its ability to encourage certain types of industry through favourable tax treatment. Government spokesmen imply that government intervention in the form of direct subsidies to industry is considered to be highly undesirable. On the other hand, tax breaks are thought to be more acceptable. In an interview in the Globe and Mail (September 21, 1981, B19) Louis Hyndman is quoted as saying, "there is a real danger in artificial subsidies". Mr. Hyndman pointed to Ontario where he said that cheap oil has meant industry has not become as efficient as it should. However, he also stated that, "it is fair ball to use the tax system partly to overcome natural barriers".

Using tax breaks "to overcome natural barriers" implies that the government will experience lower tax revenues from certain sources. This, in turn, implies that either an alternative revenue source must be found or that spending programs must be cut if the government is to avoid a budgetary deficit. An obvious source of additional revenue for the Alberta government is the petroleum industry. The dramatic 1973/74 increase in world energy prices, which resulted in controlled increases in Canadian energy prices, greatly increased provincial government tax receipts from the energy sector. From $276 million in 1971, Alberta government natural resource revenue jumped to $1372 million in 1975 (Alberta, 1980a). The suddenly swollen government coffers greatly

enhanced the government's potential ability to provide fiscal incentives such as tax advantages to industry.

Government acceptance of the concept of using tax revenues received from the petroleum industry to permit the promotion of diversification in other sectors was evident as early as 1972. In the Alberta government's "Natural Resource Revenue Plan" the concept is clearly articulated.

> Diversification of a significant nature will be difficult for a number of reasons, not the least of which are our relatively 'thin' consumer markets and transportation hurdles which affect the cost of inbound material and outbound products. It is the position of the Government that, in the Alberta public interest, significant expanded sources of Government revenues must begin to flow into the provincial treasury now in order to provide part of the funds for new programs specifically designed for such diversification. Clearly, revenues from a depleting natural resource are an appropriate source of such funds. (Richards and Pratt, 1979)

The Alberta government's perceived role as promoter of industrial growth and diversification is somewhat curious given Alberta's status as a member of a federation of provinces. Two economic justifications for the continuing existence of a federation of regions such as Canada can be identified. Firstly, there is the attainment of greater economic security due to the pooling of risks of cyclical fluctuations (both short and long-term) through inter-regional compensation and insurance programs. Secondly, the achievement of greater scale and specialization in economic activity leads to gains from trade among regional participants and higher per capita incomes (Maxwell and Pestieau, 1979). In other words, membership in Confederation should enable Alberta to specialize in the economic activities in which it has a comparative advantage without fear of too large a degree of vulnerability to shifts in world market conditions. The freedom of regions to specialize in the activities where their comparative advantage lies ensures a more efficient pattern of production within the country, in the sense that aggregate income will be greater. Alberta's drive to diversify

into activities not already established by free market forces in order to become less dependent on the energy sector appears contrary to these basic advantages of economic federalism.

The purpose of this thesis is to examine the consequences for the Alberta economy of provincial government schemes to promote diversification. A simple general equilibrium model of a small regional economy is employed to simulate the effects of various government schemes using energy revenues to encourage industrial expansion. The impact of these schemes on key economic variables such as real income, real wages, returns to labour, capital and land resources, and income distribution will be examined. To anticipate our final conclusions, an attempt will be made to demonstrate that except under certain very special conditions, Alberta's diversification policies will impose costs both provincially and nationally in terms of foregone real per capita income.

The thesis is organized as follows. In Chapter 2 the implications for a small, open regional economy, such as Alberta's, of an improvement in its terms of trade will be discussed. This chapter deals exclusively with the case where all returns accrue to the private sector. Chapter 3 extends the analysis of Chapter 2 by examining the impact of government taxation and spending schemes designed to promote diversification. Various alternative means the government could use to redistribute tax revenues and their implications for economic structure and efficiency are discussed. In Chapter 4 a brief historical review of Alberta's recent economic development is undertaken. Attention is focussed on the response in Alberta to the increases in the relative price of energy during the 1970's. In addition, past government fiscal policies which have influenced the nature of industrial growth in Alberta are examined. Chapter 5 presents the general equilibrium model of a regional economy which is used to simulate the

effects of various possible government policies to promote diversification. Chapter 6 describes and analyzes the results of the simulations that are carried out. Chapter 7 presents the conclusions of the analysis.

Chapter 2

THE ECONOMIC IMPLICATIONS FOR A SMALL, OPEN REGIONAL ECONOMY OF A FAVOURABLE SHIFT IN ITS TERMS OF TRADE WHEN ALL RETURNS ARE PRIVATIZED

2.1 Introduction

The rise in the price of energy, which commenced in 1973/74, represented a significant improvement in Alberta's terms of trade relative to eastern Canada. The extent of this improvement is indicated in Table 2.1 where selling price indices for manufactured goods (as a proxy for Ontario's export prices) and for domestically produced oil, and the ratio between the two are provided for the years from 1960 to 1980. It will be observed that while staying roughly unchanged between 1960 and 1972, the terms of trade between oil and manufactured goods rose steadily from a value of 107.2 in 1973 to a value of 230.9 in 1978. Any shift in the relative price of energy will clearly have a profound impact on Alberta. In 1971, Alberta's mining sector accounted for 40 percent of census value added in goods-producing industries in the province. Mineral fuels made up 96 percent of the value of production in the mining sector (Alberta, 1981a).

The major objective of this chapter is to determine the implications for a small, regional economy of a favourable shift in the terms of trade of its major export product such as has occurred in Alberta in recent years. To address this issue, first a review of regional growth theory will be undertaken, followed by a discussion of regional growth in the context of international trade and finance theory.

The branch of economics known as regional economics contains several approaches to regional growth. These differ widely both in their implied

definitions of growth, and in their emphasis on which factors are most important to growth. Included here are the stages theory of economic growth (Fisher, 1933; Clark, 1957; Hoover and Fisher, 1949), the export base theory (North, 1955; Stabler, 1968; Watkins, 1963) and the polarization hypothesis or the related principle of cumulative causation (Armstrong and Taylor, 1978; Myrdal, 1957; Kaldor, 1970; Dixon and Thirwall, 1975). Each of these theories will be briefly discussed in the following paragraphs in terms of their various predictions for regional economic growth. The point will be made that their ability to explain the likely course of growth in a region such as Alberta is somewhat deficient.

TABLE 2.1

PRICE INDICES FOR MANUFACTURED GOODS AND DOMESTIC OIL, AND THEIR RATIO

	(1) Total mfg. selling[1] price index	(2) Crude Oil Average Well-head price index (Western Canada)[2]	(2) (1) Oil price index/ mfg. price index
1960	82.2	83.8	101.9
1961	82.4	83.1	100.8
1962	83.3	81.2	97.5
1963	84.4	86.5	102.5
1964	85.1	89.1	104.7
1965	86.2	89.3	103.6
1966	88.7	89.5	100.9
1967	90.4	89.4	98.9
1968	92.3	89.6	97.1
1969	95.8	88.0	91.9
1970	98.1	90.4	92.2
1971	100.0	100.0	100.0
1972	104.4	100.8	96.6
1973	116.1	124.5	107.2
1974	138.1	208.3	150.8
1975	153.7	261.8	170.3
1976	161.6	305.3	188.9
1977	174.3	367.1	210.6
1978	190.4	439.6	230.9
1979	217.9	475.9	218.4
1980	247.2	563.3	227.9

1 Canada (1956-1976), Canada (1982)
2 Canadian Petroleum Association, 1980

2.2 The Stages Theory

It has been suggested in the literature that Alberta's development strategy is "rooted in the implicit assumption that regional economic growth typically occurs in a unilinear sequence of stages, the region evolving from an agricultural economy through the exploitation and export of its resources to the early and finally the advanced stages of industrialization" (Richards and Pratt, 1979, 232). According to this viewpoint, if a region does not succeed at making the transition to an industrial economy, then it is doomed to stagnation and decay. Such a line of reasoning is similar to that used in the stages theory. The stages theory, as its name suggests, emphasizes a sequence of stages which developing regions supposedly pass through before reaching the stage of a mature industrialized state. However, the stages theory does not typically incorporate resource export as a critical development stage. Instead, development is seen as mainly an internal evolutionary process. In spite of various indications that the Alberta government may perhaps unwittingly have adopted certain conclusions of the stages theory - especially those relating to the importance of industrialization - the assumptions on which the theory is based are not at all relevant to the circumstances faced by Alberta. The stages theory is presented here mainly to provide contrast to the assumptions and conclusions of the more relevant export base theory.

The crucial assumption of the stages theory is that the region in question is essentially closed to trade with other regions and to the movement of factors of production across its boundaries. Under such an assumption economic development can only be an internal evolutionary process following a sequence the nature of which will depend largely on changes in comparative costs of production, changes in income elasticities of demand, and changes in population

size (Hewings, 1977). The usual scenario described for stages-type development is one in which originally fairly self-sufficient, agriculturally-based communities coexist within a region with little contact among themselves. Eventually, such factors as improved communications and transportation facilities will make cost structures such that it will be profitable for communities to specialize their production somewhat and engage in trade with each other. The transition from subsistence to commercial and specialized agriculture is thereby initiated, resulting in per capita income growth. The next step in development is taken when the pressure of population increases and diminishing returns in agriculture threaten to halt growth or even cause a decline in per capita income. It is alleged that these circumstances will prompt the transition to an industrial society, just as past growth in per capita income will create the demand for such goods as can be provided by industry. According to the theory, this step towards industrialization is crucial if growth in per capita incomes is to continue. This conclusion is based on Malthusian reasoning that in agricultural societies population growth tends to outpace growth in essential commodities such as food supplies.

Several observations should be made with regards to the stages theory. Firstly, as noted above, the theory begins with the critical assumption of a closed regional economy, and then proceeds to describe development as, in part, an application of the theory of comparative advantage and specialization in production among sub-regional units. In contrast to the circumstances portrayed by the stages theory, a region which is open to trade need not, in general, develop primary, secondary and tertiary economic bases sequentially. External demand for the exports of the region, which depend on external incomes and on relative prices, will determine what type of economic base is established.

Furthermore, the possibility of the movement of capital and labour into the region from other regions, if employment opportunities exist, means that regional development is not constrained by the size of the indigenous population or capital supply. Technology transfers from other regions will also alter the course of development.

The second observation to be made is that the stages theory defines the general term growth as meaning intensive growth, or growth in per capita incomes. This is in contrast to the definition of growth as an increase in aggregate income required when an open region is considered. This point will be discussed further in the succeeding section on the export base theory.

2.3 The Export Base Theory

It is clear that, while perhaps applicable to the historical development of older, fairly self-contained regions such as western Europe, the stages theory is not relevant to the development of the younger North American nations. From the beginning these younger nations were very open to trade and factor movements. The unique experiences of such nations as Canada and the U.S.A. whose initial development was based largely on the export of primary products was the motivation for the elaboration of the export base theory of economic growth. The main theme of the export base approach is that the initial stimulus to growth in a region can be traced to the recognition of the possibility of profitable exploitation of the region's natural resource base. Capital and labour are therefore attracted to the region, and the exploitation of primary products, whether agricultural goods, mineral resources, animal furs, or whatever, is undertaken. From the expansion and growth of the resource-based activity, certain 'linkages' will emerge that will encourage investment in other industries,

and will result in some amount of industrial diversification in the region. The degree of industrial diversification will depend on the nature of the original resource-based activity as well as on the proximity of and access to regions of outside suppliers and markets. These so-called linkages have been classified into three categories: backward linkages, forward linkages, and final demand linkages (Hirschman, 1958; Watkins, 1963). Backward linkages refer to "the inducement to invest in the home production of inputs, including capital goods, for the expanding export sector"; forward linkages to "the inducement to invest in industries using the output of the export industry as an input"; and final demand linkages to "the inducement to invest in domestic industries producing consumer goods for factors in the export sector" (Watkins, 1963, 145).

The export base theory clearly embodies a different approach to regional development than does the stages theory. It is concerned with extensive growth, or growth in aggregate income, rather than with intensive growth. Under the assumption of openness, per capita incomes, real wages, and the rate of return on capital in the developing region cannot persistently remain above (or below) those of the larger entity from which the region draws capital and labour. Any significant divergences would attract additional labour and capital into the region (or cause factor out-migration) so that returns to factors and per capita incomes will tend to be equalized across regions, except for differences resulting from relocation costs. Thus, per capita incomes in the developing region are constrained to grow at a rate determined in the larger regional entity. Of course, the industry linkages described by Watkins (1963) as "inducements to invest" are in fact the result of temporarily higher rates of return in certain industries in the developing region. These higher returns induce capital to migrate to the region to take advantage of investment opportunities, and the

difference in returns between regions is thereby eradicated.

A region which begins development through the exploitation of primary resources by incoming factors of production must depend for continued extensive growth, at least initially, on the continued existence of world demand for its export good, and on adequate supplies of labour and capital. However, according to the export base theory, depending on the type of industries that develop through linkage effects, a falling off of demand for the region's export goods may not mean a complete reversal of the region's economic fortunes. It is suggested by some proponents of the theory (Watkins, 1963, for example) that industries which once developed as offshoots of the primary export sector may eventually become less dependent on that sector, and may begin themselves producing for export. A more industrially-diverse economy would thereby be created, no longer tied to the fortunes of one or a few primary exports. This evolution would be facilitated if the initial export required considerable investment in social overhead which created external economies encouraging the development of other export industries (Stabler, 1968).

In the export base approach, the growth of additional export industries is thought likely to result in significant industrial diversification of the regional economy. However, in contrast to the stages theory, this development is not seen by various proponents of the export base theory as being crucial either for maintaining a certain level of aggregate income or for continued extensive growth in the region even in the longer run. North (1955, 254-258) for example stated that, "there is no reason why all regions must industrialize in order to grow" and "Some regions, because of locational advantages, have developed an export base of manufactured products, but this is not a necessary stage for the sustained growth of all regions". North argues that the growth of a region is tied

to the expansion of its export base, and identifies two important conditions that will induce expansion. Firstly, technological change, such as an improvement in transportation, may enable a region to compete with other regions in the production of goods that were previously not viable in that region because of high costs. Secondly, the export base may be expanded as a result of increased demand for existing exports or for a new export good, due to an increase in income in the market area or to a change in taste. Given either of these conditions, regional growth may persist even without industrialization. Growth would, in fact, continue unchecked until either the stimulus to exports ends or shortages of factors of production, either mobile or fixed, temporarily or permanently slow down growth.

The export base approach, in its simplest form, has been criticized for being merely a description of the historical development of regions dependent on the export of raw materials, and for offering little insight into the factors which are likely to significantly affect growth (Armstrong and Taylor, 1978). In fact, as is pointed out by Tiebout (1956), the export base approach is more correctly a short run explanation of extensive growth. It cannot adequately explain growth once industrial linkages have resulted in a significant amount of industrial development that does not depend directly on the primary export sector, so that the primary export is no longer the main determinant of growth. In other words, increases in a region's exports will result in a multiplier effect on regional income as well as possible accelerator effects on investment. Through the latter, a period of induced regional (extensive) growth could be initiated where investment increases income, which in turn induces further investment, and so on. For a region that becomes capable of such endogenous growth the export base theory of growth is obviously inadequate. Regions capable of endogenous

growth will be less open than regions which cannot sustain endogenous growth. It has been shown by Hartman and Seekler (1967) that endogenous regional growth requires that there be relatively low income leakages out of the region.

To summarize the discussion thus far, it may be stated that the stages theory and the export base theory are widely divergent in their approaches to regional growth. Their abilities to describe regional development depend upon arbitrary assumptions establishing the boundaries of a region. In a fairly self-contained region, the stages theory might have some relevance in explaining both intensive and extensive growth, although proponents of the theory usually define growth as meaning rising per capita incomes. In a more open region, where exports are the most important source of income, the export base theory may be able to explain extensive regional growth. However, the export base theory will become less adequate if the region succeeds at developing a significant amount of industrial diversity generating enough internal economic activity to permit endogenous regional growth. The case of an open regional economy capable of endogenous growth can be seen as falling somewhere between the two extreme cases of a completely closed and a very open region. Regarding the importance of industrial diversification to regional prosperity, the stages theory concludes that for continued intensive growth of a closed region, Malthusian reasons make it essential. The export base approach concludes that extensive growth in a region can continue without industrialization as long as export demand and factor supplies permit.

2.4 Polarization and Cumulative Causation

The explanation of extensive growth in a region which possesses already a fairly diverse industrial structure is sometimes, in regional economic literature,

couched in terms of polarization hypotheses and the principle of cumulative causation. The concept of polarization stresses the tendency of economic activity to become concentrated geographically around an initial point of development. The reason for this concentration of activity is contained in the principle of cumulative causation.

Cumulative causation is a term used to refer to the effects of the presence of internal and external economies of scale. Internal economies imply that per unit costs of a firm decrease with the scale of output for reasons connected with the internal production process itself. External economies of scale, or agglomeration economies, imply that there may be cost reductions resulting from the spatial proximity of related activities (Armstrong and Taylor, 1978). External economies can be classified as either economies of localization or economies of urbanization (Isard, 1956; Hoover, 1963). Economies of localization arise because of the geographical concentration of plants within the same industry. For example, the proximity of one industry's plants at various stages of production provides the potential for increased specialization and a resulting reduction in long run average costs. In addition, such proximity may facilitate research and innovation within the industry (Armstrong and Taylor, 1978). Urbanization economies are those that arise from the geographical association of a large number of economic activities, not necessarily of the same industry. They result from the concentration of many facilities needed by all types of industry, such as transportation and communication facilities, and government and financial services.

As a result of the presence of internal and external economies of scale, a region which for some reason attains a head start in development will tend to increase its advantage as time goes on. The developed region will continue to

attract the capital and industry, making it difficult for less developed regions to initiate any type of industrial growth. It may be inferred from this that if the polarization hypothesis is valid, a region which receives some initial stimulus to growth, such as an increase in the demand for, or the price of, its major export good, may find that economic activity will reach some level after which extensive growth becomes self-generating or endogenous. Industrialization will continue in the region even after the original stimulus to exports subsides.

2.5 Growth Theories and the Alberta Economy

Having reviewed the substance of three regional growth theories, it may now be asked what each theory would predict as the likely course of events in Alberta following the stimulus to its exports which occurred with the energy price rise of 1973/74. The first theory, the stages theory, can be dismissed outright as being irrelevant to the circumstances of an open economy such as Alberta. The export base theory predicts that the increased value of Alberta's exports will cause an influx of labour and capital to the region to take advantage of employment and investment opportunities. The direct expansion of the primary export sector will create linkages throughout the economy of the forward, backward, and final demand type. This will stimulate some industrial diversification around the export base, the extent of which will depend on the type and extent of linkages encouraged by our export industry. These linkages are the result of income multiplier and investment accelerator effects which, if strong enough, might, according to the polarization hypothesis, cause additional industries to be attracted to the region in order to take advantage of internal and external economies of scale. In short, both the export base and polarization approaches predict that the increased value of Alberta's export product will

stimulate a broader industrial structure as is desired by the Alberta government. However, the region will remain dependent on the primary export sector unless the newly developed industries become independently viable.

2.6 A Trade Theory Approach

The conclusions implied by these regional growth theories are in stark contrast to those inferred by international trade and finance literature regarding the response of a small, open regional economy to a rise in the world price of its major export good. It would seem to be a legitimate criticism of regional theories that they largely ignore international theory which, with a few changes, can be easily adapted to the situation of inter-regional trade and payments adjustment. In the following paragraphs, a brief review will be made of the mechanisms of adjustment which can be expected to operate within a nation such as Canada in response to a shift in the terms of trade between regions, as would be predicted by standard trade and finance theory. References for this type of adjustment process include Ingram (1959), Scitovsky (1969), Powrie (1981), Whitman (1967), Armstrong and Taylor (1978), and Norrie and Percy (1981a).

For the purposes of analyzing Alberta's trade relations with the rest of Canada, Alberta will be considered as a small, open economy. Although the classification of small may not hold in every type of market in which Alberta deals, it is certainly valid in the world oil market where Alberta has no influence over price. And, it is likely accurate with regards to the Canadian labour market since as of 1978 (Canada, 1980a) only 8.8 percent of Canada's labour force and 8.3 percent of Canada's population resided in Alberta. Furthermore, in the manufactured goods sector, Alberta accounted for only 3.6 percent of Canada's total census value added in manufacturing (Canada, 1980b), and in terms of

Canada's real gross domestic product, Alberta accounted for only 10% (Conference Board, 1979). The openness of Alberta's economy is ensured to some degree by the provincial governments' lack of authority to make use of trade restrictions and tariffs. The nontariff-type barriers to trade which have emerged in recent years among the provinces do not yet appear widespread enough to cause major generalized distortions in trade and factor movements (Maxwell and Pestieau, 1980), although significant distortion with respect to specific products such as certain agricultural goods may be evident.

The implications of smallness and openness for a regional economy such as Alberta's are crucial. By being small and open, Alberta will find that prices of any of its traded goods will be determined in the larger national and international markets, and that it cannot influence these prices by its own actions. Similarly, returns to mobile factors in the province will be established in the national market. This means that excess demand for factors in Alberta will not cause the returns to these factors to be bid up across Canada. The excess demand can be met by in-migration of capital and labour with no change in average national returns to these factors. Likewise, excess demand for any traded good, such as manufactured products, will be met through increased imports and increased local production without any change in equilibrium prices of the goods. The only prices that will be determined locally are for non-traded goods such as those supplied by the service sector. Excess demand for these goods will cause their price to rise especially in the short run before additional capacity can be brought on stream.

It has already been shown that the sharp jump in energy prices, as occurred in 1973/74, represented a significant improvement in the terms of trade of Alberta relative to eastern Canada - or Ontario for short. It should be observed,

however, that these regional consequences result only to the extent that petroleum resources are owned in the West. If all Canadians owned an equal share of Canada's petroleum wealth, then the consequences for the average Canadian of a rise in the price of energy would depend on whether the country were a net importer or net exporter of energy products (Courchene and Melvin, 1980). Since petroleum resources are owned largely in the West, and since in the short to medium-term the elasticity of demand for petroleum products is known to be low, the change in the terms of trade causes a balance of payments surplus in Alberta relative to Ontario, and necessitates a transfer of income from Ontario to Alberta. If Ontario is to pay for the larger value of its energy imports, it must reduce its consumption (and/or saving), while Alberta will increase its consumption (and/or saving).

In the short run, the adjustment to the payments imbalance will occur mainly in the form of financial transfers. The fact that the provinces are part of a single nation, with one currency and a well integrated banking system and capital market, facilitates this financial transfer. Short run adjustment between regions following a trade disturbance is therefore less difficult than comparable adjustment between sovereign nations with pegged exchange rates (Ingram, 1959). Payments from Ontario to Alberta do not affect total bank reserves and deposits in Canada as a whole. No contraction of bank credit and multiple contraction of economic activity in Ontario is required, as would be the case if Ontario were an independent nation whose banks could not draw on reserves from outside the country. Thus, the national banking system ensures that increased saving in the surplus region will be recycled back to the deficit region to finance the needed energy imports.

Although the people of Ontario may postpone reducing their consumption

through borrowing and through depletion of their savings, it is inevitable that, unless the government intervenes in some way such as through the provision of equalization payments, a real transfer of income from Ontario to Alberta will have to occur. Limitations on borrowing capacity and on desired savings reductions will eventually be reached. In the long run, Ontario will have to export a greater amount of goods to Alberta (or elsewhere) in order to pay for a unit of energy imports than was necessary prior to the rise in energy prices. In the case of two sovereign nations, the needed real transfer would be prompted by exchange rate changes. With two regions tied to a fixed exchange rate, other mechanisms of adjustment must become operative.

There are three remaining avenues of adjustment which one might anticipate would work to restore balance of payments equilibrium between the two regions in the long run: Keynesian-type income adjustment, changes in relative wages and prices, and movements of factors of production between regions. In Alberta, the operation of these mechanisms might be expected to proceed as follows. Firstly, the increased value of exports will have a positive multiplier-induced effect on income. This will decrease demand for goods in Alberta - both these produced locally and those imported from outside the province. To the extent that Albertans choose to spend their increased income on imports from Ontario, the real transfer of income necessary from East to West will be accomplished automatically. The buoyant demand conditions for Alberta goods which might be expected to result from the income effect will cause production in economic sectors, in addition to the energy sector, to be expanded. This, in turn, will create an increased demand for labour in Alberta, and will put upward pressure on real wages in the province. If provincial wages were allowed to rise relative to those in Ontario, then lower labour costs would give Ontario firms a

competitive advantage over their Alberta counterparts, and, given our assumption of openness, would again serve to prompt Albertans to buy more goods from Ontario. A large proportion of these imported goods would be manufactured products. This would put strains on local Alberta manufacturers who would lose business, and consequently a contraction of Alberta's manufacturing sector would result. In reality, it is improbable that such adjustment through relative wage changes would ever have a chance to work itself out, given the fairly mobile nature of Canada's labour force. Any significant real wage differential between Alberta and Ontario would, within a short period of time, be largely eradicated as labour responded by migrating to the higher wage area. However, the migration of labour from Ontario to Alberta, by reducing aggregate absorption in Ontario and increasing it in Alberta, would accomplish a transfer from East to West without the need for relative wage changes.

With more people in Alberta as a result of increased in-migration, aggregate demand will again increase. This increase will be met, as before, partly by increased imports and partly by increased local production. With elastic supplies of capital and labour, local producers of potentially tradeable goods will likely be able to expand production to meet the increased demand. One would expect to see a reduction in the size of local industry and agriculture, compared to the pre-oil-price-rise situation, only if significant proportions of their inputs consisted of some immobile factor of production, such as land and resources, which is in limited supply in Alberta. However, given Alberta's favourable land-man ratio, the availability of land will not likely be a constraint on growth in these traded sectors at least in the long run.

It is the non-traded or service sector of the economy which could produce a bottleneck that would slow down extensive growth in the economy in the short-

term. The inflow of labour and industry to the province results in an increased demand for housing, rental accomodation and office space. A construction boom will follow, but there will be some lag due to, among other things, local government regulatory processes before urban land can be zoned and buildings constructed. Consequently, one would expect there to be a significant rise in the price of service sector output. In the very short run this phenomenon may enable the service sector to bid labour away from other local sectors whose output prices are established in the national market. However, as soon as labour is able to migrate to the province in response to wage differentials, real wages in Alberta will tend back towards the national average and the labour supply constraint will be attenuated. Nevertheless, even with perfectly elastic labour supplies, the fact that service sector prices have increased means that real wages have been reduced somewhat within the province, and, accordingly, local firms will have to offer higher nominal wages in order to keep what workers they have and to attract more. While this may be possible in the energy sector since the price of its output has risen, it may not be so in manufacturing or agricultural sectors whose output prices, determined exogenously, have not changed. Thus one may see some forced contraction in agriculture and manufacturing sectors, or even in the energy sector, if service sector prices rise significantly more than the energy price rise. None of these effects is likely to be very strong or lasting, however, given the fact that Alberta's urban centres are located on flat plains which make urban expansion fairly easy.

All of the effects discussed so far that are likely to occur in the province - changes in income, possibly some relative wage adjustment, and an influx of people - serve to increase Alberta's absorption and its total imports. A real transfer of income from East to West is thereby accomplished, and balance of

payments equilibrium will tend to be restored. In fact, it is even possible that temporarily Alberta will move from a surplus to a deficit position with respect to the rest of Canada. This may be seen by considering Alberta's marginal efficiency of capital curve which, given the booming economic conditions in this province, can be expected to shift upwards. It may be assumed that capitalists are mobile and do not need to reside in the locale where their capital is invested. Capitalists will therefore respond to changes in the nominal, rather than the real, return to capital. In response to the temporarily increased nominal return in Alberta, capital will be attracted to the province, and investment will increase. This will produce an increase in Alberta's imports indirectly through a multiplier effect on income, and also directly because of the importation of capital goods that will be needed in order to increase Alberta's production capacity. The combination of these effects with the others described previously may result in a balance of payments deficit for Alberta, but once this expansion period has ended and increased capacity comes on stream, one would expect any deficit to be erradicated (Whitman, 1967).

So far, adjustment to the rise in energy prices has been considered solely from Alberta's viewpoint. Similar types of adjustment can be expected to occur in Ontario, but in the reverse direction. Since Ontario must pay more for its oil imports, there will be less to spend on other types of imports and on domestically produced goods. Unless the decrease in domestic demand is entirely offset by increased exports to Alberta and elsewhere, there will be some demand deflationary effects on income which will also serve to decrease imports into Ontario and help to restore balance in the balance of payments. The multiplier-induced decrease in income will, in addition, put downward pressure on real wages, but given their generally recognized downward inflexibility there is more likely to be

a rise in unemployment than any real wage change. Increased unemployment will in itself reduce absorption in Ontario, and may also prompt people to leave the province. The demand deflationary effects of the oil price rise may eventually be offset to a large degree by increased exports to Alberta, but this does not change the fact that Ontario must pay more in exports for each unit of energy import than previously, and hence, there must be a reduction in the province's aggregate income and absorption.

What do these mechanisms of adjustment in response to a trade imbalance imply for Alberta's industrial structure? It may be observed that no where in the previous discussion is it inferred that the rise in the price of Alberta's energy exports will cause increased manufacturing and greater industrial diversity within the province. In fact, with somewhat less than perfectly elastic factor supplies, quite the opposite will occur. The energy and service sectors will bid up wages and attract labour away from those sectors whose output prices have not risen - likely the manufacturing and agricultural sectors. Under these circumstances, the energy price rise causes the province to become even more specialized in the production of primary energy products. But factor supplies are fairly elastic within Canada, with capital probably approaching perfect mobility and labour being fairly mobile at least in the long run within the limits set by monetary and psychic moving costs. Hence, as was suggested earlier, one might not expect to observe any contraction in manufacturing or agricultural sectors. The manufacturing sector - our main concern at this point - will probably continue its function as a supplier to local markets, and, given the increased size of these local markets, will expand somewhat. This expansion may take the form of both an increase in the variety of manufactured goods produced locally, and an increase in the amount produced. The most obvious example of industries

with potential for expansion would be those supplying products needed directly by the expanding export sector. In Alberta, for instance, local manufacturing of oil rigs might become profitable. The degree to which Alberta manufacturing will become more diverse depends on the number of commodities for which increased local demand reduces per unit production costs to an extent that makes local production competitive with production in the East plus transportation costs to Alberta.

This possible expansion of the manufacturing sector is not, however, diversification in the sense of making the economy less dependent on primary energy resources. The increased industrialization occurs only in response to local demand conditions created by the energy sector boom, and is, accordingly, dependent for its existence on continued high prices in the energy sector as well as on continued supplies of exploitable energy sources within the province. There is no indication in the trade theory which has been reviewed that an increase in energy prices will spur Alberta on to greater industrialization in the sense of becoming an exporter of industrial goods and no longer entirely dependent for its prosperity on primary energy exports.

2.7 Synthesis

If one considers this inter-regional trade analysis in conjunction with the previously discussed export base theory, it may be observed that the scenario described by the export base theory is essentially one of a booming export sector drawing people and capital into the region, and causing some industrial growth in response to growing local market demand. There is no reason to suppose that the industrial base will necessarily expand to become an independent export sector. In order for this to occur, the region must either naturally possess some

heretofore unrecognized comparative advantage in industrial production, or that comparative advantage must somehow develop as extensive growth occurs in the region.

The notion of a region developing a comparative advantage in some type of production will be recognized as the essence of the polarization hypothesis already discussed. The possibility that once a certain level of population and economic activity locate within the province significant internal and external economies of scale, or agglomeration economies, will be realized must be taken into account. The presence of agglomeration economies might make it profitable both for existing industry in Alberta to expand production in order to serve an export market as well as the local market, and for new types of industries not previously found within the province to set up production here. This process can be self-perpetuating in that as more industries are attracted to the province, additional labour supplies will be induced to immigrate, local market size will again be augmented, and further agglomeration economies may thereby be achieved. By such a process Alberta could conceivably be propelled along to the attainment of a more diverse industrial structure which is independent of the existence of the primary export sector.

The likelihood of this type of scenario transpiring within Alberta is difficult to predict. The importance of agglomeration economies as urban size increases is not easily determined with any degree of precision, although attempts at measuring the phenomenon have generally found productivity to increase somewhat with urban size (Mera, 1973; Sveikauakas, 1975; Segal, 1976). The Economic Council of Canada (1977, 131) concluded that the benefits from agglomeration economies were positive, but small, and that they existed only for urban centres below 1.4 million inhabitants.

When considering the effects of possible agglomeration economies within Canada, it must be observed that in spite of recent increases in market size in Alberta as a result of the energy boom, the markets of central Canada are still the largest and most dense in Canada. This point is made by Norrie and Percy (1981a, 73) who provide statistics showing the size and change in size of populations in census metropolitan areas between 1961 and 1976. Between 1971 and 1976, it is shown that the populations of census metropolitan areas in central Canada grew by 502 thousand, compared to 278 thousand for the West. Furthermore, the populations of census metropolitan areas in central Canada was 9002 thousand in 1976, compared with 3272 thousand in western Canada. It is also noted that urban areas in the West tend to be located at fairly large distances from one another. This may be contrasted to the situation in central Canada where there is a greater number of census metropolitan areas, and these are generally located much closer together. In addition, central Canada is in close proximity to major U.S. markets. Norrie and Percy conclude that "although urban growth in the West has been large it is not clear that it has been sufficiently large or distributed in such a way that some minimum threshold of population has been reached".

To conclude this chapter, it may be stated that there are compelling arguments based on the theory of international trade and finance for expecting the rise in the price of energy to cause Alberta to become even more specialized in the production of primary energy products. The occurrence of significant industrial diversification which becomes independent of the original export base would be an exceptional result to the shift in the terms of trade, and would have to be based on the development of some type of agglomeration economies as a result of extensive growth within the province. Furthermore, given Alberta's

locational disadvantages, it seems likely that the growth of any sort of independent industrial sector outside the primary resource sector would involve mainly service and manufacturing activities related to the natural resource sector. The development of unrelated manufacturing activities such as clothing and textile industries is, of course, highly improbable.

Finally, it must be noted that in the preceding analysis it has been implicitly assumed that all returns are privatized within Alberta. No account is taken of the existence of a government with taxation and spending powers. The ability of a provincial government to use these powers to influence income distribution can greatly alter our conclusions as to the impact of the change in the terms of trade on economic structure. It is this topic to which we shall turn our attention in the next chapter.

Chapter 3

THE ECONOMIC IMPLICATIONS OF GOVERNMENT REDISTRIBUTION OF ENERGY RENTS IN A SMALL, OPEN REGIONAL ECONOMY

3.1 Introduction

This chapter will examine the adjustment in a small, open regional economy to an improvement in the terms of trade of its primary energy export good when a portion of the returns from energy production accrue to the government. The way in which the government makes use of its share of energy revenues can profoundly influence the ultimate effect that the energy price will have on the structure of the regional economy, and on such key variables as income and real wages. In almost any discussion of this issue in the literature, the term 'economic rent' is used extensively to refer to the portion of energy revenues which exceed the return necessary to attract producers to the industry and which the government as public owner of the resources could collect. For this reason, we begin our discussions in the following section with a review of the concept of economic rent. Next, in the third section, an assessment will be presented of the economic consequences for Alberta, and indirectly for the rest of Canada, of the province's using energy rents to influence economic development.

3.2 The Theory of Economic Rent

In Canada, the British North America Act grants ownership of natural resources to the provinces. Apart from certain early alienations, the provinces have generally retained public ownership of underground hydrocarbon resources, while relying almost exclusively on the private sector for exploration and production of these resources. In 1971, in Alberta, only 12.4 percent of the total

oil and gas acreage held was accounted for by private freehold land, although private land accounted for a somewhat more significant 20 percent of oil production and 25 percent of gas production (Crommelin, Pearce and Scott, 1978, 342-343).

Provincial ownership of energy resources means that the Alberta government is extensively involved in the regulation and management of oil and gas exploration and production. The province also has the power to set prices within Alberta boundaries and apply certain types of levies and taxes to the industry. The federal government likewise exercises significant control over the energy industry, mainly through its jurisdiction over trade and commerce and its ability to apply its own taxes to the industry. Prices for Alberta's oil and gas outside of the province have, since 1973, generally been set through federal/provincial negotiation.

In its role as owner of natural resources, the Alberta government is in a position to appropriate any return to the energy industry which it believes is in excess of that required to ensure that firms continue to explore for and produce oil and gas within its boundaries. Any such surplus return is usually referred to as economic rent, a term which has been in use since the days of Ricardo and Marshall, but whose meaning has at times been rather confused (Blaug, 1978; Worcester, 1946). The meaning of economic rent accepted today is described by Joan Robinson (1954, 102) as "the conception of a surplus earned by a particular factor over and above the minimum earnings necessary to induce it to do its work." These minimum earnings, or transfer earnings as they are often referred to, must include all production costs, as well as opportunity costs. Opportunity costs are determined by what the factor could earn in its next most profitable line of employment. As will be indicated shortly, this definition of rent is not as

clear-cut as it may at first seem.

The significance of the presence of economic rent is that since it is a surplus return, the government is able to appropriate it without altering the allocation of resources within the economy. Any attempt to confiscate more than the economic rent will result in a contraction of the industry. Whether or not the government has a right to receive this economic rent is a matter of value judgement. If one adheres to a cost-of-production theory of value, then rents must be considered as unearned income. But the income is unearned whether it is received by the owner of the factor of production, which in the case of natural resources is the government, or by owners of the capital and labour services which will carry out exploration and production. A government's claim to economic rent must be based on its ability to use the rent in a way that is superior to what private industry would do with it from society's point of view (Steele, 1967). This superior ability could involve either more efficient resource use or what is judged by society to be a more appropriate distribution of income.

Across any nation (or group of nations) where a factor is relatively free to move, after-tax returns to that factor will tend to be equalized, except for differences caused by costs of moving from one region to another. Thus, any economic rent earned temporarily by a factor which is mobile will eventually be dissipated. Any attempt to tax a mobile factor at a rate higher than the national average would result in an exodus of the factor from the region until after-tax returns are again approximately equalized across regions. Only immobile factors in an open economy have the potential to earn economic rent over the longer term. Clearly, Alberta is in the fortunate position of possessing significant quantities of an immobile factor - petroleum resources -which, owing to recent world price increases, are earning greatly enhanced rents that the government is

able to tax away. This optimistic description of Alberta's position needs, however, to be qualified by a more indepth consideration of the concept of economic rent - an entity which in practice is very difficult to measure and whose theoretical relevance is questioned by some writers.

In classical theory, economic rent is thought to arise for two reasons. Firstly, if a factor is homogeneous in quality, but limited in supply, scarcity rents will appear equal to the difference between the equilibrium price and the price that would be just necessary to bring all available factors into production. Secondly, when factors differ in quality, the scarcity of factors of a particular quality gives rise to differential rents (Blaug, 1978). The rents arising in the energy industries today are the result of the artificial restriction of supply of low cost energy sources by OPEC nations. The setting of oil prices by OPEC has enabled higher cost pools to be exploited in non-OPEC nations which would not normally be viable. This has provided increased rent for oil fields above the marginal field.

In practice, any attempt to determine precisely which portion of a factor's return is pure economic rent will be fraught with difficulties. What might appear to be rent may in fact be only quasi-rent, the taxation of which would alter resource allocation in the long run. Quasi-rents are defined to be rents earned in the short run only, and whose presence is necessary in order to stimulate longer run supply responses. For example, if the demand curve for a certain capital good shifts to the right, prices will rise, since in the short run the existing capital stock is fixed in supply. Quasi-rents will therefore be earned in the short run, but will be eroded in the longer run as new capital goods are constructed, shifting the short run supply curve to the right. Accordingly, if one assumes that capital goods will always be reproducible given a long enough time

period, all surplus returns to capital must be considered as quasi-rents.

The distinction between rent and quasi-rent essentially involves the determination of the elasticity of supply of a factor of production. If in the very long run the supply of a factor is perfectly elastic, then all of the return to a factor will affect its eventual long run supply, and there exists no pure economic rent - only quasi-rent. If on the other hand, the long run supply curve is upward sloping, implying a shortage of certain quality-types of the factor even in the long run, then some pure economic rent will exist for the above marginal factor, and this rent can be taxed away without altering resource allocation.

Land, or the mineral resources contained within the land, would appear to represent a good example of a factor which can indeed earn economic rent. Land that can supply mineral resources is ultimately in inelastic supply, and hence a portion of its return should qualify as pure rent. However, the difficulty of devising a tax which confiscates only pure economic rent is made abundantly clear in the literature (Crommelin, 1977; Steele, 1967; Webb and Ricketts, 1980). In order to distinguish between economic rent and normal return, some knowledge of supply elasticities of land is necessary. Such knowledge is difficult to obtain, particularly in the mineral industries where the existence of exploration costs complicates the differentiation between transfer earnings and economic rent. Exploration costs make it difficult to decide how much of the net return to mineral extraction should be regarded as rent to land and how much is the return on capital invested.

This question of differentiating between the return to capital and the rent accruing to land was debated extensively some sixty years ago among such economists as Alfred Marshall, L.C. Gray, and F.W. Taussig. The issue is summarized thoroughly by Steele (1967). The general conclusion reached by

Steele (1967) regarding economic rent in the mineral industries is that only the return to the landowner, as opposed to the return the owners of capital or to prospectors for mineral resources, comes close to the definition of pure economic rent. The return to landowners is a return to an agent who does not participate in the production process, and it can therefore seemingly be appropriated without altering the allocation of resources within the economy. However, this conclusion must be qualified by the further consideration that land is in some sense producible, just as mineral resources are augmentable. What may appear to be rent received by landlords may indeed still only be justifiably classed as quasi-rent, since its magnitude will alter the long run supply response of mineral-rich land.

This argument has been used in the literature to support the contention that in reality there is no economic rent. Blaug (1978) contrasts the notion of rent as perceived by classical economists with more modern viewpoints. Classical economists originally applied the concept of economic rent solely to land. Land was considered as a special type of productive factor in that it was entirely fixed in supply, inexhaustible, non-reproducible, and thus did not require to be paid in order to exist (Robinson, 1954). Accordingly, it was thought to differ fundamentally in nature from man-made means of production and reproducible human labour. Blaug rejects this view of land as being different from other factors. Both land and resources, like any other capital good, require initial development and subsequent maintenance in order to be put into productive use. Furthermore, Blaug holds that no productive factor, including land and other natural resources, is ever completely non-reproducible and incapable of being adapted to other uses; it all depends on the time period relevant. Blaug notes that the supply of land and resources may typically be much less elastic than the

supply of capital goods in certain instances, such as in a settled country. However, according to Blaug, modern theory holds that land (meaning all types of resource inputs) should be treated as just another type of capital good.

> In long-run stationary equilibrium, the total product is resolvable into wages and interest payments to labour and capital - there is no third factor of production ... (Blaug, 1978)

It is clear from the frequency with which the term economic rent is still used in the literature, especially in dealing with natural resource industries, that many economists would disagree with Blaug's interpretation of 'modern theory'. There are several counter-arguments one can pose against Blaug's argument for the irrelevance of economic rent. Firstly, one might argue that since the earth's crust is finite, some limit to the reproducibility of land and resources must eventually be met, even given the possibility for technical progress. Thus in the very long run, land and those natural resources for which there exist no satisfactory man-made substitutes will earn some pure economic rent. A somewhat more practical argument can be articulated by considering the viewpoint of the authorities of a small, regional economy. The notion of economic rent which can be taxed away without changing resource allocation may be relevant even in the short run if authorities are concerned only with a limited time horizon, and are thus not worried about any supply distortions which might occur beyond that time period. Furthermore, authorities may only be concerned with the effects of rent redistribution within their own jurisdictions. Once resource supply is exhausted within their jurisdiction, future supply responses and distortions are beyond their realm of responsibility.

Even if one accepts the argument that economic rent can, for practical purposes, be defined for a small economy whose government is concerned only with possible supply distortions within its boundaries and within a limited time

span, it is generally recognized that attempting to devise a method of capturing economic rent, which will not in itself distort resource allocation decisions, is an almost impossible task in the mineral industries where risk is present. Firstly, there is the problem of the timing of rent collection (Crommelin, 1977). If authorities devised some means of calculating the magnitude of rent, its exact calculation would have to wait until a mineral deposit was exhausted so that actual revenues and costs would be known. But such a delay in rent collection would provide little incentive for private operators to minimize costs, if all charges were allowed as deductions from revenues. On the other hand, if all charges were not allowed, there would be the "administrative nightmare" of deciding which costs were deductible and which were not (Crommelin, 1977, 277). If it were desired that rent should be collected before the termination of a mining operation, then it would have to be collected with respect to expected revenues and costs - thereby introducing an element of risk with the possibility that either the producer will suffer a loss or the government will fail to collect all the rent. This problem could be overcome if government could provide at the outset full information with respect to the nature of the deposit and then auction off rights to exploit the deposit. In practice, of course, complete and accurate information regarding the characterization of any particular deposit is available only near the end of the deposit's producing life.

A second problem faced by authorities attempting to collect economic rent is choosing a tax scheme which itself will not be distortionary. In practice, many of the various tax measures available to appropriate rent, such as severance and property taxes, are not neutral in effect (Crommelin, 1977; Webb and Rickets, 1980). Whenever a producer is motivated to alter his economic behavior in response to a tax measure, he is not bearing the entire burden of the tax, and the

government is not collecting the maximum possible rent. It is well known that one means of appropriating rents often used in the industry - competitive bidding - could in theory, under conditions of perfect competition, obtain the available rent in its entirety. In a competitive auction for the right to explore and develop a property, the sum received by the government would represent the full present value of the economic rent. The maximum sum competitive firms would be willing to pay would be that which reduced the present value of the project to zero when evaluated at the firm's own discount rate. The amount paid by the firm will represent a sunken cost, and therefore will have no influence over subsequent development and production decisions based on marginal revenue and marginal cost (Crommelin, 1977).

Obviously the assumptions of perfect competition - especially those of perfect knowledge, the absence of uncertainty, and no collusive behavior - will usually be far from the truth in the petroleum industry. The inappropriateness of competitive bidding under the conditions of extreme uncertainty often found in the oil and gas industry is one of its major drawbacks. At the time of commencement of exploratory drilling in a new location, firms may have only a very vague idea of the probability of finding a deposit, much less any notion of its size and commercial value. Under such conditions, bonus bids are unlikely to bear much relation to the final rents (if any) which accrue to the firm (Webb and Ricketts, 1980). One of the major issues here is the question of who is responsible for obtaining information about a resource deposit - the government or private firms.

To summarize the discussion thus far, it may be stated that there exists considerable difficulty in defining a portion of a producer's revenue over total current outlay that can be designated as pure economic rent and therefore ripe

for collection by the public owner. In addition, there exist problems in finding a neutral means of appropriating whatever portion of a producer's return which is labelled as rent. These two conclusions suggest that for practical purposes, the neutral confiscation of rent by government is not a realistic goal. This suggestion is supported by Bradley (1976). He points out that if neutrality is indeed out-of-reach at the present time, then governments must assume a broad role in the mineral industries. Different levels of taxation will generally be associated with different levels of activity in the resource industries. Governments must therefore become involved in the management of resource development, rather than simply being concerned with the appropriation of economic rent.

The foregoing discussion must be kept in mind when considering the ability of government to successfully appropriate revenue from the energy industry. In the remainder of the thesis for convenience, the term economic rent will be used freely. However, it is intended that its meaning be taken somewhat loosely to refer to a portion of energy revenues which the government can collect without causing significant changes in industry behavior which are undesirable from society's point of view.

3.3 Government Redistribution of Energy Rents

Having discussed the theory of rent and the government's ability to confiscate the rent earned by an immobile factor, attention will now be turned to the economic consequences for Alberta and for the rest of Canada of different ways that the Alberta government could redistribute this rent. Three possible distribution schemes will be examined. The first is a privatization scheme in which the government collects rent from the energy companies and

redistributes it directly to persons living in Alberta at a certain designated time. The second involves the government's using the rents to promote industrial diversification. This may consist of reductions in taxes on labour and/or capital, or increased public expenditure while leaving taxes constant. Alternatively, the government may choose to encourage certain types of industry by reducing the price charged for specific intermediate inputs required by these industries below the current market price. The third scheme entails the government's placing the rents it collects into a provincial savings fund. A partial list of references dealing with these issues of rent redistribution includes Scarfe and Powrie (1980), Courchene and Melvin (1980), McMillan and Norrie (1980a), McMillan and Norrie (1980b), McMillan (1981), Norrie and Percy (1981a), Norrie and Percy (1981b), Drugge and Veeman (1980), Helliwell (1980), Scott (1975), Scott (1980) and Thirsk (1978).

An important point to remember, when evaluating different rent distribution schemes, is that, given Alberta's status as a small, open regional economy, labour and capital are generally free to migrate into and out of the province in response to differences in real per capita incomes, real wages, and nominal returns to capital across the country. Therefore, the province cannot hope to achieve any degree of intensive growth significantly greater than the national average, no matter how rents are redistributed. However, the manner in which rents are redistributed by the provincial government will have an important impact on factor migration to the province, and accordingly, on the amount of extensive growth that takes place. In the discussion that follows, an attempt will be made to show that government rent redistribution schemes which result in more extensive growth in Alberta than would be dictated by free market forces (as in the 'no government' scenario discussed in Chapter 1) can impose

costs on Canada and on Alberta due to an inefficient allocation of resources across Canada. An inefficient resource allocation will be taken to mean one in which marginal products of productive factors are not equalized across the country, so that a redistribution of factors would increase real national income. Thus, with each rent distribution scheme examined, an important question to be answered is what is the impact of the scheme on factor migration and on extensive growth compared to that which would occur under the 'no government' scenario described in Chapter 1.

It will be recalled that in the 'no government' scenario, energy rents are privatized. The only ones to benefit from the energy price rise are the owners of factors employed in the energy sector prior to the unexpected windfall gain. Any future anticipated energy price increases will be capitalized into factor prices. Owners of land resources in the energy sector may continue to earn increased returns (rents) after the energy price rise if the supply of the resource land is fairly inelastic. Any migration of factors to the province that occurs under this scenario, is the result of demand conditions within the province and not an attempt on the part of factors to share in energy rents **per se**. Furthermore, assuming competitive market conditions so that factors are paid according to their marginal products, factors will migrate until returns or marginal products are approximately equalized across the nation. No reallocation of factors could increase national income, and hence this scenario yields an efficient outcome, according to the above criterion. It is, of course, implicitly assumed that society is prepared to accept the resulting distribution of income.

A government initiated privatization scheme in which Alberta residents of say 1973 are granted portable ownership rights to energy rents will have an effect on factor migration similar to that of the 'no government' case. Claims to

all present and future energy rents are dispersed at one time, after which there is no incentive for factors to migrate to Alberta except in normal response to excess demand condination so as to approximately equalize marginal products. There is no reason based on our efficiency criterion to prefer leaving the rents in the hands of the energy firms over distributing them to Alberta residents. A decision to adopt one scheme or the other would instead have to be based on equity principles as to which is the most 'fair'.

It may also be noted that from the point of view of the non-oil producing provinces, neither scheme should seem wholly undesirable since under both energy rents would still be subject to federal taxation. Non-oil producing provinces would receive a share of Alberta's wealth indirectly through the increased revenue received by the federal government. Furthermore, if under the government-initiated privatization scheme, shares given to Albertans were marketable, then any Canadian could purchase a claim on future energy rents, as would be the case if rents were left with energy firms. Albertans with newly acquired wealth would be expected to make use of it in a manner which does not discriminate against non-oil producing provinces in terms of either consumption or investment.

In deciding whether to leave rents with the energy firms or to distribute them amongst Albertans, it seems logical to assume that the government would choose the latter as the one which provides the most direct benefits to Albertans. However, there are at least two reasons why one might not expect the Alberta government to select this direct distribution scheme over other possible choices (Courchene and Melvin, 1980). Firstly, privatization directly to Alberta residents means that energy rents wll be spent or saved by their recipients at their own personal disgression. This leaves no room for the Alberta

government to use the rents to direct provincial development as it sees fit. It is possible that the social rate of time preference may differ from the private rate, so that to optimize the welfare of Albertans the provincial government should direct how the rents are used. Secondly, by privatizing rents in the manner suggested, the government would not be maximizing the wealth of Albertans since it would be allowing the rents to be subject to federal taxation. Albertans would receive the full present value (i.e. before-tax value) of the energy rents only if the provincial government sheltered them from federal taxes by distributing them through some other means, such as tax reductions or increased spending. This is not to imply, however, that the utility gain to consumers will necessarily be greater if the provincial government chooses to distribute rents through either of these latter means than in the case of direct distribution to private agents. As is pointed out by Norrie and McMillan (1980a), differing tax burdens among individuals and the uneven distribution of benefits from the public sector make it difficult to determine the net effect of provincial government utilization of energy rents.

The second government-imposed rent distribution scheme to be considered is the collection of rents for use in the promotion of province-building objectives. Province-building refers to the government's goal of cultivating a more diverse provincial economy with a larger industrial base. There are several ways in which this might be accomplished, including reducing taxes on capital and labour, or increasing government expenditures while keeping taxes constant. The results for a small, open economy such as Alberta of employing any one of these techniques are similar. Economic incentives, both within Alberta and between Alberta and the other provinces, will be distorted from those present in the 'no-government' scenario; migration of capital and labour will occur in response to

these distorted incentives; and an inefficient allocation of resources will result.

As an illustration, suppose Alberta reduces its tax on individuals while maintaining the same level of public services. This implies that both real and nominal after-tax real wages (and other types of income) in Alberta will have increased relative to other provinces, which will encourage labour to migrate to the province at a higher rate than under the previous privatization scenario. Migration will continue until after-tax real wages are again approximately equalized, but in the process before-tax wages, both real and nominal, will be bid down. In the long-run equilibrium state, migration to the province will be reduced to its 'normal' level but Alberta, in effect, becomes a low before-tax wage province. Before-tax real wages will be lower than elsewhere in Canada by an amount equal to the tax advantage offered to labour. Lower labour costs will enable local firms to expand production, new firms will be attracted to the province, and perhaps some new types of industry will be started up which were previously not viable in Alberta. In short, some expansion and diversification of the industrial base will occur. The amount that takes place will depend on several factors including the importance of labour costs to various types of industry. Obviously, even with lower labour costs, some industries will not be attracted to the province because of its various locational disadvantages in relation to other Canadian regions. In addition, the expansion of industry in the province will be constrained by the supply of fixed and immobile factors of production, such as the supply of land and resources.

Lowering taxes on labour will thus promote the government's diversification objectives, but it will do so only at the cost of some loss in efficiency. The efficiency loss is caused by the fact that the in-migration of labour will lower real wages and depress the marginal product of labour in Alberta below the

national average, although after-tax real wages will still be equalized across regions. Income is not being maximized provincially or nationally; a redistribution of labour from Alberta to elsewhere in Canada where its marginal product is higher will increase real national income in both aggregate and per capita terms.

A parallel analysis can be applied to the case of reductions in the tax on capital. Capital will migrate to the province and some diversification will occur. But this will cause the marginal product of capital to be lower in Alberta than elsewhere, so that aggregate and per capita real national income is not being maximized and resources are inefficiently allocated.

These conclusions regarding the non-optimal results of capital and labour migration in response to government-provided incentives - or fiscally-induced migration as it is referred to in the literature - will also hold in the case of increased government spending, with taxes unchanged. The decision by labour to migrate to Alberta will be based not only on comparative returns in the private sector, but also on a comparison of public goods and services offered in the various provinces. Therefore, a move by the government to increase public expenditure in order to supply goods and services at less than their opportunity cost to Alberta residents will induce labour from other regions to move to the province. Labour migration will continue until real per capita income is approximately equalized across Canada, with income viewed in terms of an individual's command over both private and publicly provided goods. Because of the cheaper government provided goods available in Alberta, real per capita income, in terms of both public and private goods, will be equalized across regions when nominal private sector wages are lower in Alberta than elsewhere. Accordingly, under this scenario, Alberta becomes a low nominal wage province, which will as before induce some industrial diversification. But, also as before,

the marginal product of labour will be depressed in Alberta, so that resource allocation from a national viewpoint will be inefficient.

It may be noted that the inefficient resource allocation which results from these government schemes will not be obvious to the residents of the region since they are financed by resource revenues which have historically accrued to the government. If schemes to encourage industry in the region were financed from higher taxes, then their cost would be clearly evident and residents might be less inclined to be supportive of these schemes. As Norrie and McMillan (1980a) point out, province-building would likely have proceeded at a much slower pace in Alberta if energy rents in the province were not collected by the province but rather by private residents.

An alternative means to promote diversification, and in particular to encourage growth in specific industries, is for the government to set the price charged for natural resource inputs to these industries at below market price. In addition the government would have to insist that the intermediate input continue to be supplied in the required quantities to the industries which are being promoted. An example of such a practice in Alberta would be the provision of relatively low-cost natural gas feedstock (compared to Alberta's natural gas export price) to the petrochemical industry. This practice will clearly cause the petrochemical industry to expand production and to demand increased quantities of natural gas. At the same time, the natural gas industry should be induced to contract production as the average price received for its product has declined. From an efficiency standpoint, the petrochemical industry is using too much natural gas. The marginal product of the natural gas input has been depressed in the petrochemical industry. A redistribution of the input away from petrochemicals would raise real per capita income. Clearly, efficiency has

been sacrificed for growth in certain industries which have been deemed as desirable to the economy.

The conclusion that fiscally-induced migration of either labour or capital, or the underpricing of natural resource inputs, will lead to an inefficient allocation of resources must be qualified by one important stipulation. This stipulation is that no significant agglomeration economies will result that are sufficient to stimulate certain industries to a point where these industries will be viable even after energy resources are depleted and government redistribution of energy rents has ended. In international trade literature, the presence of agglomeration economies would be referred to as a domestic distortion for which corrective government action is justified. A domestic distortion is said to be present when the familiar conditions for the optimality of free trade are violated. Instead of the marginal rate of transformation in domestic markets (MRT_d) equaling the marginal rate of substitution in consumption (MRS) which in turn equals the marginal rate of transformation in foreign trade (MRT_f) the following inequality holds: $MRT_d \neq MRS = MRT_f$. This inequality describes a situation where there are externalities in production, such as in the case of agglomeration economies where the presence of one industry confers side benefits on other industries which are not taken into account in the production decisions made by the first industry. Under these circumstances, the first best policy for the government would be the provision of a subsidy equal to the degree of external economies. This line of reasoning is also the basis for infant industry or infant economy arguments for the protection through subsidies of industries expected to yield substantial external benefit through labour training, and knowledge creation and diffusion (Chacholiades, 1978; Corden, 1974). If domestic distortions and infant industry type arguments could be shown to be valid in

Alberta's case, then government rent redistribution schemes can be viewed as a means of correcting market distortions which are currently preventing a more 'natural' degree of economic diversification (McMillan and Norrie, 1980a). However, to date the lack of secondary industry in Alberta can be attributed more to environmental factors such as the nature of its resource base, the sparse population, geographic isolation and harsh climate than to any sort of market distortion (Norrie, 1976 and 1978).

The final method of rent distribution to be considered is the setting up by the provincial government of a savings fund to which a portion of its share of energy revenues will be allocated. Alberta's Heritage Savings Trust Fund (HSTF), into which 30 percent of energy revenues are directed, is intended to be used both as a savings vehicle and a means to promote economic strength or diversification. It is the former role with which we are concerned at this point. At the time of its creation, it was thought that by providing a vehicle for public saving, the Heritage Fund would benefit the province in several ways. Firstly, it was observed that the Fund would enable the provincial government to continue to provide a similar degree of government services in the future as those offered at the present time, even after the depletion of oil and gas reserves, and without having to sharply increase taxes. In this manner "the inevitable upward adjustment of personal and corporate tax rates could be made more gradually than otherwise would be possible" (Collins, 1980, 159). Secondly, it was observed that the creation of the Fund would involve "a part of our capital stock now in the form of non-renewable resources (being) converted into another form, namely real and financial assets, preserving a portion of our wealth for future generations" (Collins, 1980, 159).

Implicit in the creation of a public savings fund to accomplish these

objectives is the assumption that private savings and consumption decisions are not socially optimal, and, in particular, that private citizens will not save enough. This viewpoint is supported by Scarfe and Powrie (1980) who argue that although it is unclear "whether or not private time-preference rates exceed the social time-preference rate (...), it is quite conceivable that in their savings decisions private individuals would fail to take account of the impact of those population changes which result from interprovincial migration". The government must take into account the need to supply new immigrants with public goods and also to continue the provision of a reasonably high level of public goods and services after the stream of non-renewable resource revenues begins to decline on a per capita basis. It follows that the government may need to operate at a lower discount rate than the private individual.

Scarfe and Powrie (1980) undertake some rough calculations to estimate the optimal saving rate required from income generated by resource rents associated with the depletion of a non-renewable resource stock in order to maintain a constant level of consumption per head. These calculations indicate that Alberta's 30 percent saving rate for the HSTF may be too low. They are, however, based on the assumption that both long-time and newly arrived provincial residents are given equal weight in the "objective function". A 30 percent savings rate would be more in line with the optimal rate under the assumption that new residents are somehow to be excluded from benefiting from the resource revenues.

The ability of the provincial government to influence the level of savings in the province and in the nation as a whole through the HSTF will depend on the extent to which the Fund merely displaces private savings. The displacement of private savings is most likely to occur under the following sets of circumstances:

firstly, if part of the Fund were used as a pension fund and, secondly, if savings designated for the Fund are generated by a direct levy on corporate profits (Scarfe and Powrie, 1980). The first situation is not relevant at the present time in Alberta. The second is more relevant as it seems likely that if the province sharply reduced its royalties on oil and gas production, energy firms would retain and reinvest a substantial portion of their increased revenues, as opposed to distributing them either to shareholders as dividends or to consumers through lower prices. Thus, the collection of royalties by the province likely reduces private savings in the corporate sector (Scarfe and Powrie, 1980). Nevertheless, it may be observed that total Canadian savings will almost certainly increase when resource royalties are saved and invested by the provincial government because the large degree of foreign ownership in the oil and gas industry implies that any corporate savings reduction would consist largely of the savings of foreign shareholders (Wilkinson and Scarfe, 1979). However, it must also be noted that savings still may not be any greater when it is carried out by the provincial government than when energy rents are distributed directly to Alberta residents and savings decisions are left up to individuals. Furthermore, an argument to leave increased rents in the hands of industry because a substantial portion will be retained and reinvested may be questionable on equity grounds as such actions would constitute the granting of a subsidy to industry.

To the extent that the provincial government is able to influence the level of savings in the province through the HSTF (and through general budget surpluses), it will be able to use the Fund as an economic stabilizer. This function of the Fund is emphasized by Scarfe and Powrie (1980). It is evident that if all energy revenues appropriated by the government were spent on current consumption rather than saved, severe 'overheating' of the Alberta

economy would be the likely result. By accumulating as savings a substantial portion of the energy revenues, the government is suppressing part of the stimulus to demand and in-migration caused by energy revenues.

It must, of course, be recognized that the very existence of a pool of savings, such as the HSTF, may act as a stimulus to migrants who anticipate future benefits from those savings. However, Scarfe and Powrie still argue that the Fund will act as an economic stabilizer because,

> if the benefits of resource revenues are received by residents as continuing income rather than as a lump sum, their present value is high only to those who plan to remain in the province indefinitely, and the migration of transients is not encouraged. (Scarfe and Powrie, 1980, 171)

If, on the contrary, energy revenues are distributed as quickly as they arise, there may be a sudden influx of migrants to receive the benefits of the revenues, followed by an outflow of migrants as soon as revenues dwindle. Such sharp swings in population would create various economic adjustment problems for the province caused by, for example, sudden changes in the level of demand for public services.

Courchene and Melvin (1980) point out, however, that compared with a once-and-for-all privatization scheme, the existence of the Fund will lead to much larger inflows of people. Furthermore, they do not think it obvious that the Fund will necessarily reduce in-migration compared with the situation of using rents to decrease taxes or increase public services. The outcome will depend on the 'entry-price' to Alberta under each rent distribution scheme - or, in other words, it will depend on the degree to which energy rents would be capitalized in housing and rental prices. It may be noted, however, that the capitalization of rents into housing and rental prices is only a short-term disequilibrium phenomenon. In the longer run, more housing and rental units will

be built and rents dissipated. McMillan and Norrie (1980, 219) also express doubt that the HSTF will serve as a significant economic stabilizer. They make the point that the economic impact of a scheme of total rent privatization where rents are spent on private consumption and investment will likely be "spatially more dispersed, and hence more moderating, than when spent by government, particularly one intent on province-building."

In summary, it may be stated that the consequences for efficiency of this third scheme of rent distribution are ambiguous. The effects may be positive, both for Canada and for Alberta, if through government-imposed savings a more nearly optimal savings rate is reached. Indeed, Scarfe and Powrie are emphatic about this point:

> (...) it is essential for the whole of Canada that someone undertake the required savings to finance the vast investment expenditures that will be essential as our non-renewable resource stocks, and especially our reserves of conventional oil and natural gas, are depleted. We believe that the major share of the economic rents associated with the extraction of these non-renewable resources should remain with the producing provincial governments, also because this may be the only way to ensure that the required saving in fact occurs. (Scarfe and Powrie, 1980, 176)

However, the potential positive benefits of this provincial saving may be outweighed by the negative effects of any resource misallocation that would result if the Fund acts as a strong stimulus to migration.

To review this discussion of various rent distribution schemes, it may be stated that any scheme which distributes rent over a prolonged period of time and which makes residency in Alberta a condition for receiving the benefits of the rents will give rise to fiscally-induced migration of factors of production, and will result in an inefficient allocation of resources across Canada. The cost of this inefficient allocation, both to Albertans and to other Canadians, can be measured in terms of the difference in the marginal product of productive

factors under the scheme which produces fiscally-induced migration compared to a scheme which is neutral with respect to migration.

These arguments can be phrased alternatively in terms of the optimality of free trade. Government tax reductions on productive factors and increased provision of services at less than opportunity cost can be viewed as subsidies to industry, and as such act as non-tariff barriers to trade between Alberta and the rest of Canada. According to the well-accepted principles that free trade is superior to restricted trade and that restricted trade is superior to no trade, removal of these subsidies would unambiguously increase welfare in Alberta and in the rest of Canada (Chacholiades, 1978). This is not to imply, however, that everyone will be better off in the freer trade situation. In fact there may be some individuals who stand to gain substantially from the implementation of the non-tariff barriers. For example, people who own houses and land in urban areas in Alberta - that is, owners of immobile productive factors - would see the price of these assets rise substantially under a provincial government scheme to encourage extensive growth. Owners of land for urban development will obviously be better off. Homeowners will benefit from the increased value of their dwellings only if they are able to realize the capital gain and then relocate to a lower cost housing area. The main point is that under free trade, or less restricted trade, the gainers will gain more than the losers will lose. In other words 'potential welfare' has increased for all individuals because the gainers under free trade could bribe the losers to accept the free trade option and still remain at least as well off, but the losers could not bribe the gainers to accept the restricted trade option.

Chapter 4

A HISTORICAL REVIEW OF ALBERTA'S DEVELOPMENT OVER THE PAST DECADE

4.1 Introduction

This chapter will survey some historical statistics which describe the nature of Alberta's development over the past few decades, and especially since the energy price rise of 1973/74, in comparison to the development of other provinces. Two main questions will be asked in this brief historical review. Firstly, has Alberta's response to the energy boom been in accordance with the predictions of international trade and finance theory for increased specialization in non-renewable energy industries as reviewed in Chapter 2? Secondly, to what extent has the Alberta government used its share of energy rents to enable it to reduce taxes and/or increase public expenditure to promote its province-building objectives? For a full discussion of province-building, the reader is referred to Pratt (1977) and Richards and Pratt (1979).

4.2 Alberta's Response to the Rise in the Relative Price of Energy

Statistics showing compound annual growth of various economic indicators for Canada, Ontario, and the western provinces are provided in Table 4.1. These data give some idea of the magnitude of the effect that the rise in the relative price of energy has had on Alberta's economy. Not surprisingly, all these economic variables show a signficiant increase in growth rate in Alberta compared with the rest of Canada in the years following the first dramatic rise in energy prices. For example, for the time periods of 1961-66 and 1966-73, Alberta's gross domestic product at factor cost grew at a rate that was above that for the whole of Canada by 0.2 and 1.7 percentage points respectively.

TABLE 4.1

COMPOUND ANNUAL GROWTH RATES FOR
VARIOUS ECONOMIC INDICATORS FOR
CANADA, ONTARIO & THE WESTERN PROVINCES, 1961-78[1]

	1961-78	1961-66	1966-73	1973-78
a) Gross Domestic Product at Factor Cost				
Canada	11.0	9.1	10.5	13.9
Ontario	10.7	8.8	10.7	12.5
Manitoba	10.1	7.4	10.0	12.8
Saskatchewan	11.1	13.8	6.9	14.6
Alberta	13.4	9.3	12.2	19.6
British Columbia	12.1	9.8	12.5	13.8
b) Real Domestic Product (1971)				
Canada	5.2	6.7	5.2	3.6
Ontario	5.0	6.8	5.4	2.9
Manitoba	4.4	5.4	4.7	3.0
Saskatchewan	4.8	9.2	1.5	5.2
Alberta	6.5	6.2	6.8	6.2
British Columbia	6.1	7.8	6.4	4.1
c) Population				
Canada	1.5	1.9	1.4	1.3
Ontario	1.8	2.2	1.8	1.3
Manitoba	0.7	0.9	0.5	0.7
Saskatchewan	0.1	0.0	-0.3	0.9
Alberta	2.3	1.9	2.1	2.9
British Columbia	2.6	2.8	3.0	1.9
d) Personal Income				
Canada	11.4	8.9	11.4	14.1
Ontario	11.2	8.9	11.5	13.1
Manitoba	10.4	7.3	11.0	12.8
Saskatchewan	11.6	13.6	8.7	13.8
Alberta	12.0	8.9	12.0	17.2
British Columbia	12.3	9.3	13.0	14.4
e) Personal Income Per Capita				
Canada	9.8	6.9	9.8	12.6
Ontario	9.2	6.5	9.5	11.7
Manitoba	9.7	6.3	10.5	12.0
Saskatchewan	11.4	12.8	9.5	12.7
Alberta	10.1	6.9	9.7	13.9
British Columbia	9.4	6.2	9.7	12.3
f) Employment				
Canada	3.0	3.6	2.8	2.6
Ontario	3.2	3.6	3.2	2.6
Manitoba	1.8	1.6	2.0	1.8
Saskatchewan	1.6	1.3	0.7	3.1
Alberta	4.0	3.4	3.5	5.3
British Columbia	4.4	5.4	4.3	3.5

1 Source: Norrie and Percy, 1981a, 89A.

However, for the period of the energy boom, 1973-78, Alberta's rate was above that of Canada's by 5.7 percentage points, and was also well above those of the other western provinces and of Ontario. For growth in real domestic product, Alberta is again consistently above the Canadian average for each of the time periods except 1961-66. The years 1973-78 show the greatest difference of 2.6 percentage points above the national growth rate. Data for population growth rates show that Alberta's population grew at precisely the national rate for 1961-66, surpassed it by 0.7 percentage points in 1966-73, and surpassed it again in 1973-78 but this time by 1.6 percentage points. Growth rates for personal income tell a similar story. Alberta achieved the national rate in 1961-66, surpassed it by 0.6 percentage points in 1966-73, and by 3.1 percentage points in 1973-78. Alberta's 1973-78 personal income growth rate exceeded that achieved by Ontario by a substantial 4.1 percentage points. Growth rates for personal income per capita in Alberta are, of course, lower than aggregate personal income growth rates because of Alberta's positive population growth rates, particularly in the 1973-78 period. Personal income per capita grew at around the national average for 1961-66 and 1966-73, while in 1973-79 it exceeded the national average by 1.3 percentage points and exceeded Ontario's rate by 2.2 percentage points. Finally, Alberta's employment growth rate remained close to the national average in 1961-66, surpassed it in 1966-73 by 0.7 percentage points and again in 1973-78 by 2.7 percentage points.

In spite of these significant increases in the growth rates of various economic variables in Alberta, it is important to note that the province's regional shares of Canada's population, labour force, and real gross domestic product have not yet shown any substantial change. In Table 4.2 it is indicated that from 1961 to 1978 Alberta's share of the population increased by only 1.0

TABLE 4.2

REGIONAL SHARE OF POPULATION, GROSS DOMESTIC PRODUCT AND TOTAL LABOUR FORCE, 1961 to 1978[1]

	1961	1966	1973	1978
Panel A - Regional Shares of Population				
British Columbia	8.9	9.3	10.5	10.8
Alberta	7.3	7.3	7.6	8.3
Saskatchewan	5.1	4.8	4.1	4.0
Manitoba	5.1	4.8	4.5	4.4
West	26.4	26.2	26.7	27.5
Ontario	34.2	34.6	35.9	35.9
Quebec	28.8	28.8	27.5	26.8
Central Canada	63.0	63.4	63.4	62.7
Atlantic Provinces	10.6	10.4	9.9	9.8
Panel B - Regional Shares in Real GDP (1971 Dollars)				
British Columbia	10.2	10.7	11.6	12.0
Alberta	8.2	8.0	8.9	10.1
Saskatchewan	4.1	4.6	3.6	3.9
Manitoba	4.6	4.2	4.1	4.0
West	27.1	27.5	28.2	30.0
Ontario	41.3	41.5	41.9	40.5
Quebec	24.9	24.6	23.7	23.3
Central Canada	66.2	66.1	65.6	63.8
Atlantic Provinces	6.7	6.4	6.2	6.2
Panel C - Regional Shares in Labour Force				
British Columbia	8.8	9.6	10.6	10.9
Alberta	7.6	7.6	8.0	8.8
Saskatchewan	4.9	4.4	3.8	3.9
Manitoba	5.3	4.8	4.5	4.3
West	26.6	26.4	26.9	27.9
Ontario	36.7	37.2	38.1	38.1
Quebec	27.9	28.2	26.9	26.0
Central Canada	64.6	65.4	65.0	64.1
Atlantic Provinces	8.8	8.2	7.9	7.9

1 Source: Norrie and Percy, 1981a, 92A.

percentage point, from 7.3 to 8.3 percent. Ontario's share of the population remained at 35.9 percent in 1978, while central Canada overall accounted for 62.7 percent. Regional labour force statistics are of a similar magnitude. Alberta's share of real gross domestic product increased by only 1.9 percentage points from 1961 to 1978. Ontario's share decreased by 0.8 of a percentage point during that same period, but still remained at 40.5 percent in 1978. Ontario and Quebec combined made up 63.8 percent of real gross domestic product in 1978. Thus, the substantial portion of Canada's economic activity is still to be found in central Canada.

In Table 4.3, statistics showing the share of the labour force employed in various categories of non-agricultural activities in each of Canada's regions are presented. It may be observed that the data for Alberta indicate no really substantial shifts in the dominant labour force activities between 1961 and 1978. The largest change that occurred between these years was in the share of labour in manufacturing and this decreased by 2.2 percentage points from 12.9 to 10.7 percent. The decrease in manufacturing's share of the labour force is also evident in the other regions with a 0.9 percentage point decrease in the Atlantic provinces, a 7.3 percentage point decline in central Canada, a 6.2 percentage point decline in British Columbia, and a 2.1 percentage point decrease in the prairie provinces overall. The sector which shows an increase across all regions between 1961 and 1978 is the service sector. This trend is as one might expect in the later development stages of a nation where high incomes create an increased demand for the income-elastic goods of the service sector. Comparing Alberta to central Canada in Table 4.3, it may be noted that for all three years shown, Alberta employs a larger portion of its labour force in the service sector, while in manufacturing central Canada's employment share is consistently

approximately double that of Alberta's.

An indication of any recent shifts in the relative importance to Alberta of various economic sectors will also be found in provincial gross domestic productby industry (GDP) data as is presented in Table 4.4. These data tend to

TABLE 4.3

DISTRIBUTION OF NON-AGRICULTURAL EMPLOYMENT BY SECTOR AND REGION, 1961 to 1978[1] (PERCENTAGES)

	1961	1973	1978
British Columbia			
Primary	5.6	4.7	4.1
Manufacturing	23.2	18.9	17.0
Construction	4.7	6.4	5.3
Services	66.5	69.9	73.6
Alberta			
Primary	6.8	5.9	6.8
Manufacturing	12.9	12.2	10.7
Construction	9.1	9.4	9.9
Services	71.1	72.5	72.6
Prairie Provinces[2]			
Primary	4.1	4.1	4.6
Manufacturing	12.9	12.2	10.8
Construction	7.1	6.9	7.4
Services	75.9	76.8	77.2
Central Canada			
Primary	3.0	1.6	1.5
Manufacturing	33.0	28.4	25.7
Construction	6.0	5.4	4.6
Services	58.0	64.6	68.2
Atlantic Provinces			
Primary	7.4	4.2	3.9
Manufacturing	15.7	16.1	14.8
Construction	6.3	6.7	5.2
Services	70.6	73.0	76.1

1 Sources: Norrie and Percy, 1981a. Canada, 1978b. Canada, 1981.

2 Including Alberta.

confirm the trend suggested by the employment data of Table 4.3 that Alberta's manufacturing sector is becoming less prominant in the provincial economy. From 1972 to 1979 manufacturing's share of GDP in Alberta decreased by 4.3 percentage points, from 19.1 to 14.8 percent. Manufacturing's share actually increased by a small amount in Ontario during these years (0.3 percent). In Canada overall manufacturing's share decreased by 4.7 percentage points. Another sector which experienced a marked decline in Alberta is the primary renewable sector, which, between 1974 and 1979, declined by 4.2 percentage points. This sector increased its share by 0.9 percentage points in Ontario during the same period and by 0.7 percentage points in Canada overall.

TABLE 4.4

PERCENTAGE DISTRIBUTION OF PROVINCIAL GROSS DOMESTIC PRODUCT BY SECTOR FOR ALBERTA, ONTARIO AND CANADA, 1972, 1974, 1977 AND 1979[1]

	1972	1974	1977	1979
Alberta				
Primary Renewable	15.2	17.3	9.2	11.0
Manufacturing	19.1	16.5	15.8	14.8
Electric Power	4.8	3.5	4.1	3.9
Construction	19.6	16.4	21.5	21.8
Mining	35.6	41.5	44.1	43.8
Ontario				
Primary Renewable	5.4	6.3	6.0	6.3
Manufacturing	66.8	64.7	65.0	67.1
Electric Power	4.1	3.9	5.5	5.2
Construction	13.0	12.8	12.2	9.6
Mining	4.1	6.0	3.9	4.4
Canada				
Primary Renewable	9.7	12.0	9.6	10.4
Manufacturing	54.1	50.7	49.4	49.4
Electric Power	4.7	4.2	5.5	5.8
Construction	15.4	15.0	16.0	13.6
Mining	8.4	11.1	11.5	13.3

1 Source: Canada, 1982b

The sector which has gained most from 1972 to 1979 in Alberta is, not surprisingly, the mining sector which increased its share of provincial GDP by 8.2 percentage points. This compares to a 0.3 percentage point increase in Ontario over the same time period, and a 4.9 percentage point increase in Canada overall.

The impression created by these regional GDP statistics is qualified somewhat by a consideration of GDP by industry for Canada's regions as a percentage of total Canadian GDP. Table 4.5 shows provincial distribution of the mining industry. As would be expected, Alberta's share of this sector is large and has increased over the period 1972 to 1979 from 40.2 percent to 51.6 percent of Canada's total mining activity. Central Canada's share is much less and has declined from 31.7 percent to 19.0 percent over that same time period - a decrease of 12.7 percentage points. Percentage distribution of manufacturing, presented in Table 4.6, indicate that Alberta's share of Canadian manufacturing activity has also increased since 1972. Alberta accounted for 3.4 percent of census value added in manufacturing in 1972 and for 4.7 percent in 1977 - a rise of 1.3 percentage points. During the same period, central Canada's share of census value added in manufacturing has declined from 81.0 to 77.0 percent. Thus, although the importance of manufacturing within Alberta appears to have declined relative to other sectors, particularly mining, in Canada as a whole, Alberta's share in manufacturing has not only held its own, but has actually increased. These observations regarding Alberta's manufacturing sector are not unexpected. The booming natural resource sector will stimulate demand for manufactured goods within the province and thereby encourage expansion of local manufacturing industries.

TABLE 4.5

PROVINCIAL GROSS DOMESTIC PRODUCT[1]
BY INDUSTRY - MINING
MILLIONS OF DOLLARS (PERCENT)

	1972	1973	1974	1975	1976	1977	1978	1979
Canada	3348.1	5024.2	6567.4	6771.7	7865.9	9064.6	9849.8	13800.7
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
Atlantic	189.6	248.5	290.8	342.7	449.3	460.0	351.1	587.8
Nfld.	99.7	125.2	290.8	342.7	449.3	460.0	351.1	587.8
	(3.0)	(2.5)	(2.3)	(3.1)	(3.9)	(3.8)	(2.5)	(3.4)
P.E.I.	0.3	0.2	0.1	--	--	--	--	--
	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
N.S.	55.5	56.3	65.1	63.5	80.5	113.4	106.5	116.2
	(1.7)	(1.1)	(1.0)	(0.9)	(1.0)	(1.3)	(1.1)	(0.8)
N.B.	34.1	67.2	74.6	66.9	59.2	65.6	112.7	194.3
	(1.0)	(1.3)	(1.1)	(1.0)	(0.8)	(0.7)	(1.1)	(1.4)
Quebec	358.6	482.0	581.1	503.2	677.7	737.1	726.4	917.2
	(10.7)	(9.6)	(8.8)	(7.4)	(8.6)	(8.1)	(7.4)	(6.6)
Ontario	703.8	1082.0	1453.8	1128.9	1261.1	1203.1	1222.4	1707.6
	(21.0)	(21.5)	(22.1)	(16.7)	(16.0)	(13.3)	(12.4)	(12.4)
Prairies	1787.4	2482.5	3469.2	4090.2	4572.6	5590.1	6298.6	8569.7
Man.	160.4	265.6	246.7	170.3	207.5	125.4	184.9	403.2
	(14.2)	(11.6)	(11.0)	(13.1)	(13.3)	(12.2)	(10.9)	(11.0)
Sask.	279.8	343.3	404.7	445.3	504.5	660.5	860.6	1041.8
	(8.4)	(6.8)	(6.2)	(6.6)	(6.4)	(7.3)	(8.7)	(7.5)
Alta.	1347.2	1873.6	2817.8	3474.6	3860.6	4804.2	5253.1	7124.7
	(40.2)	(37.3)	(42.9)	(51.3)	(49.1)	(53.0)	(53.3)	(51.6)
B.C.	300.9	658.5	631.0	613.2	849.1	866.9	933.6	1578.7
	(9.0)	(13.1)	(9.6)	(9.1)	(10.8)	(9.6)	(9.5)	(11.4)

1 Source: Canada, 1982b

TABLE 4.6

PROVINCIAL GROSS DOMESTIC PRODUCT[1]
BY INDUSTRY - MANUFACTURING
MILLIONS OF DOLLARS (PERCENT)

	1972	1973	1974	1975	1976	1977	1978	1979
Canada	21433.4	25366.2	30073.3	31242.4	35428.1	38788.3	44444.6	51374.5
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
Atlantic								
Nfld.	116.9	163.1	220.2	180.5	220.2	299.2	332.2	406.9
	(0.5)	(0.6)	(0.7)	(0.6)	(0.6)	(0.8)	(0.7)	(0.8)
P.E.I.	19.7	23.0	26.8	29.8	34.8	37.6	50.7	66.8
	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
N.S.	317.8	404.3	491.8	556.7	588.4	631.7	766.8	870.9
	(1.5)	(1.6)	(1.6)	(1.8)	(1.7)	(1.6)	(1.7)	(1.7)
N.B.	291.7	382.4	527.1	514.2	550.0	567.3	637.6	760.2
	(1.4)	(1.5)	(1.8)	(1.6)	(1.6)	(1.5)	(1.4)	(1.5)
Quebec	5810.0	6602.8	8032.5	8544.9	9421.6	10332.9	11843.7	13704.0
	(27.1)	(26.0)	(26.7)	(27.4)	(26.6)	(26.6)	(26.6)	(26.7)
Ontario	11548.5	13524.3	15578.0	16012.0	18207.7	19858.2	22485.6	25838.0
	(53.9)	(53.3)	(52.4)	(51.3)	(51.4)	(51.2)	(50.6)	(50.3)
Prairies								
Man.	515.6	618.3	775.5	884.2	973.8	983.2	1098.3	1337.1
	(2.4)	(2.4)	(2.6)	(2.8)	(2.7)	(2.5)	(2.5)	(2.6)
Sask.	207.2	266.0	309.8	359.6	391.1	407.9	462.4	554.1
	(1.0)	(1.0)	(1.0)	(1.2)	(1.1)	(1.1)	(1.0)	(1.1)
Alta.	722.6	862.9	1117.0	1350.1	1525.5	1717.7	2059.9	2412.8
	(3.4)	(3.4)	(3.7)	(4.3)	(4.3)	(4.4)	(4.6)	(4.7)
B.C.	1881.1	2515.9	2811.3	2806.4	3508.2	3946.1	4702.0	5413.2
	(8.8)	(9.9)	(9.3)	(9.0)	(9.9)	(10.2)	(10.6)	(10.5)

1 Source: Canada, 1982b

From this brief statistical review, it may be concluded that Alberta's development since the rise in energy prices is generally in accordance with that which would be predicted by international trade and finance literature as a likely response to an improvement in the terms of trade. The rise in energy prices created economic boom conditions within the province as is indicated by above average growth rates in gross domestic product at factor cost, population, personal income in both aggregate and per capita terms, and employment. The non-renewable primary resource sector increased in relative size within Alberta as is evidenced by the census value added data, while the manufacturing sector and the primary renewable sector both declined in relative size. Alberta appears to have become more specialized in the non-renewable sector. In contrast to these changing relative shares within Alberta, on a nation-wide basis, Alberta's share of census value added in manufacturing has increased somewhat. As noted above, these observations are an indication of the needed increase in manufacturing activity within Alberta to supply local markets, which have been stimulated by the energy boom and augmented by labour in-migration in response to the energy boom. In short, Alberta's experience since the rise in the relative price of energy has involved an increase in aggregate economic activity within the province and, also, an increased reliance on the exploitation of primary non-renewable resources.

4.3 Changes in Alberta Government Taxation and Spending Policies

We now turn to the second question posed at the beginning of this chapter as to the nature of the Alberta government's development goals as reflected in part in fiscal policy in recent years. Provincial rates for three selected taxes are presented in Table 4.7. It is clear from this table that for some time Alberta

TABLE 4.7

SELECTED PROVINCIAL TAX RATES[1]

	Sales Tax Rate (%)					Personal Income Tax Rate (%) (as a % of federal tax)					Corporate Rates (%)				
	1967	1969	1974	1978	1981	1967	1969	1974	1978	1981	1967	1969	1974	1978	1981
Nfld.	6	7	8	11	11	28.0	33.0	40.0	58.0	58.00	11	13	13	12/14[3]	12/15[3]
P.E.I.	5	7	8	8	10	28.0	28.0	36.0	50.0	52.50	10	10	10	10	10
N.S.	6	7	7	8	8	28.0	28.0	38.5	52.5	52.50	10	10	10	12	13
N.B.	6	7	8	8	8	28.0	38.0	41.5	53.8	52.45	10	10	10	9/12[3]	9/14[3]
Que.	8	8	8	8	8				___[2]	___[2]		12	12	12	3/13[3,4]
Ont.	5	8	7	7	7	28.0	28.0	30.5	44.0	46.00	12	12	12	10/13[3]	10/13/14[5]
Man.	5	5	5	5	5	33.0	33.0	42.5	54.0	54.00	11	11	13	11/15[3]	11/15[3]
Sask.	4	5	5	5	5	33.0	33.0	40.0	53.0	52.00	11	11	12	11/14[3]	10/14[3]
Alta.	0	0	0	0	0	28.0	33.0	36.0	38.5	38.50	10	11	11	11	5/11[6]
B.C.	5	5	5	5	6	28.0	28.0	30.5	46.0	44.00	10	10	12	12/15[3]	8/16[3]

1 Source: Canadian Tax Foundation, 1979; Canadian Tax Foundation, 1981.
2 Quebec rates under its own schedule starting in 1978 range from 13% to 33% of taxable income.
3 First rate applies to small businesses; second rate is the general rate.
4 Quebec's effective rate of 3% on small business corporations applies as of July 1, 1981.
5 Ontario levies 10% on small businesses; 13% on larger companies in manufacturing and processing, farming, or the extractive industries; and a 14% general rate for all others.
6 In Alberta, the rate for business income not qualifying for the small business rate is 5% for professional corporations, and 11% for other corporations.

has established tax rates that are lower than those set in the other provinces. Alberta remains the only province where a sales tax has not been implemented. Personal income taxes in 1967, 1969, and 1974 in Alberta have been at or slightly above the average rate of the other provinces. In 1978, when six of the provinces raised personal income tax rates to over 50 percent, Alberta remained the only province with a rate below 40 percent. In 1981, Alberta's personal tax rate remained at 38.5 percent. Corporate tax rates in Alberta have generally been at an about average level, but in 1979 a substantially more favorable rate of 5 percent was applied to small businesses with less than $150 thousand of taxable income. In 1981, this rate was the lowest in Canada for small businesses, except for the newly introduced rate of 3 percent in Quebec.

It is expected that as of 1982 significant changes will be made to Alberta's corporate income tax structure as a result of the Alberta government's decision to administer and collect its own provincial corporate income tax starting on January 1, 1981. According to government statements, the purpose of this measure is to introduce a "made-in-Alberta" business incentive tax system tailored to "overcome hurdles in the marketing and transportation of products and to strengthen the competitive position of Alberta business, particularly smaller enterprises" (Edmonton Journal, March 7, 1980, D10). Consequently, one can expect to see in the near future an even more favorable tax treatment for business in Alberta.

The advantageous Alberta tax rates for persons and for corporations will clearly provide some incentive for capital and labour to migrate to the province. An indication of the extent of the incentive for labour is provided in Table 4.8 where per capita levels of personal income taxes, sales taxes, and gross government expenditures in each of the provinces are presented. Alberta's per

TABLE 4.8

SELECTED SOURCES OF PROVINCIAL REVENUE AND GROSS EXPENDITURE PER CAPITA[1] (ESTIMATED)

	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	All Prov.
1978-79											
Personal income tax per capita	270	238	314	296	195	416	309	327	351	464	468
General sales tax per capita	278	178	168	196	213	205	148	169	--	262	192
Gross government expenditures per capita	2575	2241	1967	1943	2335	1801	1789	2059	2454	1959	2057
1976-77											
Personal income tax per capita	193	146	208	216	579[2]	266	285	301	239	294	348
General sales tax per capita	251	167	166	167	215	216	178	187	--	273	199
Gross government expenditures per capita	1,674	1,794	1,458	1,522	1,787	1,417	1,022	1,766	1,838	1,662	1,665
1972-73											
Personal income tax per capita	65	54	104	92	265[2]	153	141	82	139	168	172
General sales tax per capita	110	110	110	108	124	114	96	87	--	123	107
Gross government expenditures per capita	988	985	800	906	926	852	811	765	887	772	865

1 Source: Canadian Tax Foundation, 1975, 1979, and 1981.
2 Includes Quebec payroll tax.

capita income tax has remained consistently below the all-province mean for the years shown, in spite of the absence of provincial sales tax. In contrast, gross government expenditures per capita exceeded the all-province mean in each of the years.

The government's ability to institute favorable tax and expenditure programs is ensured by the large revenues it receives from natural resources. Table 4.9 gives the 1977-78 distribution of selected provincial revenue sources in absolute and percentage terms. During that year, Alberta received 56.6 percent of its gross revenue from natural resources - far more than the percentage received from that source in any other province. Furthermore, these data do not include the 30 percent of government resource revenues which are directed into the Heritage Fund. If the Heritage Fund is included, then the share of government revenue originating in the natural resource sector is even higher.

Personal income taxes accounted for 9.9 percent of revenues in Alberta, which is much less than the total for all provinces of 21.8 percent. Alberta's corporation income tax accounted for a larger portion of revenue than the provincial total by 1.9 percent, even given Alberta's slightly less than average corporate tax rate. In absolute terms the total revenue received by Alberta compared to that of the other provinces was third largest, exceeded only by Quebec and Ontario. In per capita terms it exceeded that of all the other provinces by a minimum of $1100. These statistics make it evident that the revenues received by Alberta from the resource industries provide the provincial government with substantial leverage in its ability to bid for capital and labour in the national market and to induce expansion in industries which it deems as being desirable for the province.

TABLE 4.9

SELECTED SOURCES OF PROVINCIAL GOVERNMENT REVENUE, 1977-78
IN MILLIONS OF DOLLARS[1] AND PERCENTAGES[2,3]

	Nfld.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Total
Personal Income Tax											
millions of dollars	128.8	21.5	208.6	158.1	3916.9	2874.3	322.3	296.9	599.7	948.9	9476.0
percentage	12.2	9.0	15.5	14.0	30.5	23.0	19.5	16.3	9.9	20.2	21.8
Corporation Income Tax											
millions of dollars	24.5	3.1	32.0	25.1	398.0	790.2	87.9	73.6	412.5	260.4	2107.3
percentage	2.3	1.3	2.4	2.2	3.1	6.3	5.3	4.0	6.8	5.5	4.9
Natural Resource Revenues											
millions of dollars	18.0	0.3	6.6	9.4	102.5	98.3	21.6	380.3	3257.7	455.9	4350.7
percentage	1.7	0.1	0.5	0.8	0.8	0.8	1.3	20.8	53.6	9.7	10.0
General Sales Tax											
millions of dollars	157.7	23.2	151.9	123.4	1413.8	1945.2	197.0	183.0	--	759.9	4955.1
percentage	14.9	9.7	11.3	10.9	11.0	15.5	11.9	10.0	--	16.2	11.4
Total Gross General Revenue											
millions of dollars	1057.0	239.2	1343.7	1129.2	12831.6	12521.8	1653.6	1824.5	6076.6	4698.6	43375.9
Per Capita Revenue											
millions of dollars	1874.0	1993.0	1609.0	1644.0	2045.0	1499.0	1607.0	1947.0	3205.0	1884.0	1870.0

1 Excludes revenue going to Alberta Heritage Trust Fund.
2 Percentage of total revenue accounted for by selected sources.
3 Source: Canadian Tax Foundation (1980).

4.4 Conclusion

To conclude, it may be stated that during the past several decades Alberta has applied generally lower personal and business tax rates compared to the other provinces. Since the early 1970's this tax structure has become even more advantageous to businesses and individuals relative to the other provinces, particularly with respect to the personal income tax. In addition, government expenditures per capita have exceeded those in other provinces by a substantial amount. These changes since the energy price rise of 1973/74 would be expected to cause some increased fiscally-induced migration to the province, and, as a result, some increment in the degree of industrial diversification. In spite of this, it has been shown in the first half of this chapter that Alberta has, in fact, become less industrially diverse since the energy boom and more dependent on primary non-renewable resources. It may be supposed that without the increase in government expenditures per capita and the only very modest personal income tax increases during the past decade Alberta would have become even more dependent on the energy industry than has been the case, and that manufacturing would have reduced its share of Alberta's census value added by an even larger degree. Moreover, it is clear that the Alberta government has both the ability and the intent to make the province's tax structure even more beneficial relative to the other provinces, especially with regards to the corporate income tax. Hence, it is reasonable to expect in the future an intensification in the amount of fiscally-induced migration to Alberta and an expansion of industry within the province.

Chapter 5

DESCRIPTION OF THE MODEL

5.1 Introduction

Thus far our discussions have centred upon what economic theory has to say about the adjustment in a small, open regional economy to an improvement in its terms of trade both in a situation where all rents accrue to the private sector and one where a portion of rents accrue to the public sector. These discussions were followed in Chapter 4 with a brief historical and statistical review of Alberta's development before and since the improvement in its terms of trade. It was pointed out in the fourth chapter that some redistribution of energy rents by the Alberta government has presumably taken place as is evidenced by the high proportion of government revenue originating from the natural resource sector and the high level of gross government expenditures per capita in Alberta compared to other provinces. It was also suggested that the Alberta government intends to further its plans to strengthen local industry through changes in corporate income tax.

In this chapter, we will continue our investigation of the effects of government attempts to redistribute natural resource rents through the use of a simple, general equilibrium model of a regional economy. The model will be employed to simulate the effects of five possible rent distribution schemes, given an initial exogenous increase in the price received for the output of the natural resource sector. The schemes to be investigated were chosen both for the ease with which they could be introduced into the model and for their potential significance to the circumstances of Alberta, as discussed in the previous chapter. The first scheme investigated will serve as a reference case for purposes of comparison with other cases. No government sector is included

in this first case so that all rents accrue to the private sector. The second case attempts to simulate the effects of government's using incremental revenues received from the non-renewable resource sector to permit a reduction in taxes on labour. The third case considers again the lowering of taxes on labour by government, but also tries to model the behavioral assumption that labour is attracted to the province by the real value of the Heritage Fund in addition to real wage differentials. The fourth case looks at the effects of government attempts to stimulate primary manufacturing industry within the province by underpricing natural resource feedstock to that sector. Finally, the last case considers the consequences for the regional economy of the lowering of taxes on capital within the province.

The purpose of this chapter is to describe in detail both the structure of the model that was employed and the way in which the different simulations were carried out. A presentation and a discussion of the simulation results are provided in Chapter 6. The basic model outlined in the following pages is due to Norrie and Percy (1981b). This thesis extends their work by employing their model to simulate several alternate methods of rent distribution using an improved data base.

5.2 A Model of a Regional Economy

The Norrie and Percy model specifies economic relationships within the regional economy which are all consistent with utility maximization by consumers and cost minimization by producers. The only exception to this is the intentional distortions introduced to the government behavioral equations in order to model specific rent distribution schemes. The model is based on standard microeconomic relationships between economic agents, and makes the

usual assumptions of competitive factor and output markets, full employment and complete information.

The model consists of forty-six endogenous variables including such items as output prices, factor prices, investment, savings, and the balance of payments. Exogenous variables include foreign prices of imports and exports, factor prices in other regions, various technical parameters, and the price of output from the non-renewable resource sector. The value of parameters in the model were determined using historical data or, in some cases, informed guesses. The origin of all data employed is detailed in Appendix I.

Five different cases, each entailing different assumptions about the distribution of economic rent, are simulated using the model. In addition, these five cases are each broken down into two or three separate subcases employing differing assumptions about factor supply elasticities and the existence of depletion in the energy sector. The notion of time is crudely taken into account through the specification of various factor supply elasticities. In the short run, it is assumed that supplies of labour, capital and land are very inelastic with respect to factor returns. In the long run, labour and capital are assumed to be highly responsive to changes in factor returns, with capital approaching perfect mobility. Land supplies are taken to be somewhat elastic in the long run, except for the supply of non-renewable resource land which is deemed to be inelastic in both the short and long run. In two of the five cases, a simple notion of resource depletion is incorporated into the long run simulations.

The model is presented in two different forms in this chapter. Firstly, the non-linear algebraic equations are described. Secondly, each of the equations is totally differentiated so that the model can be linearized and presented in a rate-of-change format. It is this latter linearized form of the model which is

exogenous shocks, and the resulting percentage changes in the endogenous variables required to maintain equilibrium are calculated. The two shocks imposed are first, a 1.0 percent increase in the price of non-renewable primary resource output (that is, energy), and second, a 1.0 percent autonomous shift in demand for service sector output. This latter shock is imposed by Norrie and Percy (1981b) in order to capture the shift in demand for service sector output (especially construction) in the short run which will result from the desire to add capacity in anticipation of future price increases. In the long run simulation, only the first shock - the 1.0 percent increase in the price of non-renewable primary resource output - is imposed.

The model can be described most clearly by classifying each equation into one of five categories: production; aggregate demand; factor supplies; prices, income, and the government sector; and savings, investment, and the balance of payments. Each of these blocks of equations is discussed in turn.

5.2.1 Production

The model describes a stylized economy composed of six sectors. Production in each sector is characterized by equation (5.1).

$$X_i = X_i(L,\ K_i,\ R_i,\ X_{ji}) \qquad i = 1 \ldots 6 \tag{5.1}$$

where,

X_i output of sector i

L labour input

K_i sector specific capital input

R_i sector specific land or natural resource input

X_{ji} purchased inputs from sector j used in sector i

Sectors one and two represent the non-renewable and renewable natural resource industries, respectively. The most important component of sector one is the oil and gas industry while sector two consists of agriculture and forestry. Resource industries are disaggregated into two separate sectors to permit the application of differential tax rates, and to allow for different resource supply elasticities. Similarly, the factors of production, capital and natural resources, are entered separately in the production function to permit differing rates of return for each factor.

Sectors three and four are the manufacturing sectors differentiated by the degree of processing. Sector three is made up of primary manufacturing or resource processing industries and is assumed to produce both for domestic consumption and for export. The output of sectors one and two are important intermediate inputs into this sector. No natural resource input is included in the inputs for sector three ($R_3 = 0$). Primary manufacturing is specified as a separate sector so that it can be singled out for specific government incentive schemes not applicable to other types of manufacturing. Sector four consists of secondary manufacturing industries which produce solely for domestic (regional) consumption. This sector's production fulfills only a portion of the region's requirements with the rest made up by imports. As with sector three, no land input is considered in sector four ($R_4 = 0$). Sector five is the service sector producing non-tradeable goods for local consumption. Land is an important input into this sector.

The sixth sector consists of government goods and services such as education, roads, libraries, and police for which user fees cannot be levied. The goods and services included in the government sector are assumed to be provided through the use of general government revenue and not through the application

of benefit tax or fee for service schemes. Those services for which fees are charged are included in the service sector. It is further assumed that the government uses only labour and intermediate goods and services to produce its output ($R_6 = K_6 = 0$). These factors are purchased at their market prices. The incorporation of a separate government sector permits the modelling of changing incentives for inter-regional factor migration arising from the pricing of public goods.

In the model, the sectoral production functions are not specifically employed, but, rather, the dual cost functions are used. Assuming competitive factor and output markets, the equilibrium condition can be specified that unit cost equals price in each sector.

$$C^i(W, rk_i, rr_i, P_{ji}) = P_i \qquad i = 1...6 \tag{5.2}$$

where,

W = the wage rate

rk_i = the rental rate of capital specific to sector i

rr_i = rental rate of land specific to sector i

P_{ji} = the price of intermediate inputs of sector j used in i

P_i = producer price of i

In the above equation, P_6can be thought of as the average cost to government of providing one unit of public sector output.

The second equilibrium condition to be specified is that factor demand equals factor supplies.

$$C^i_{rk_i} (\cdot)\ X_i = K_i \qquad K_i = 1...5 \tag{5.3}$$

$$C^i_{rr} (\cdot)\ X_i = R_i \qquad R_i = 1,2,5 \tag{5.4}$$

$$\sum_{i=1}^{6} C^i_W (\cdot)\ X_i = L \tag{5.5}$$

In these equations $C_x^i(\cdot) = \frac{\partial C^i(\cdot)}{\partial x}$ and (by Shepard's Lemma) is the cost minimizing input of the factor associated with factor price x per unit of output i (Diewert, 1974; Epstein, 1974).

5.2.2 Aggregate Demand

Equation (5.6) specifies the general relationship between supply and demand. Domestic supply of any output equals the sum of final demand (Q_i), intermediate use ($\Sigma C_j^i(\cdot)X_j$), and net exports (NE_i). The output of sectors one and two is either exported or used as intermediate input - none enters final demand.

$$X_i = Q_i + NE_i + \Sigma C_i^j(\cdot)X_j \qquad i = 1...6 \qquad (5.6)$$

Final demand by domestic consumers, as specified in equation (5.7), depends on real income per capita, all prices, and population.

$$Q_i = (L)\ (Y^D/L)^{n_i}\ \pi(P_j)^{\varepsilon_{ji}} \qquad i,j = 3...6 \qquad (5.7)$$

L = regional labour force which is assumed a constant multiple of population

Y^D = real income available for spending on final consumption goods

P = product price except in the case of sector 6 where the price is P_6'

ε_{ij} = own and cross uncompensated price elasticities

n_i = income elasticities of demand

The specification of intermediate demands for X_i follows from the definition of the cost minimizing input of good i per unit of good j (equations (5.3), (5.4) and (5.5)).

The demand for exports of the outputs of sectors two through four is a function of the sector's price relative to foreign prices.

$$NE_i = E_i \left(P_i/\overline{P}_i\right)^{T_i} \qquad T_i < 0 \quad i = 2,3 \qquad (5.8)$$

$$T_i > 0 \quad i = 4$$

T_i = the elasticity of export demand for the output of sectors two and three, and the elasticity of import supply for sector four

$\overline{P}_i$ = exogenously determined prices in other regions

T_i is assumed to be large and negative for sectors two and three as these goods are relatively homogeneous in quality and have close substitutes from competing supply areas. However, for two reasons it is unlikely that the elasticity of export demand for these sectors' outputs will ever approach infinity. Firstly, in a few cases Alberta is a significant source of supply. Secondly, transport costs provide the region with a captive market of some size. For sector four, T_i is likely to be fairly large and positive because of the small size of Alberta's market for secondary manufacturing in relation to potential supply from central Canada or the rest of the world.

The price of sector one's output is treated as exogenous, either set at world levels or by government fiat.

$$P_1 = \overline{P}_1 \qquad (5.9)$$

Demand for the non-traded service sector output depends solely on domestic final and intermediate demand. The government sector also produces only for the domestic market. The government sector contrasts with the service sector in that the 'price' charged for a unit of government services may not equal the cost of the resources used to produce the output. The 'price' of government sector output paid by consumers, TL, is the per capita levy imposed by the government. If there were no other government revenues or expenditures, and if the government were constrained to balance its budget, the per capita levy would equal the average cost of providing the services. However, with some

revenues received from other factors (capital and land) the government will be able to charge a per capita levy which is less than the average cost of the services and will still be able to balance its budget. The price paid by consumers for government output is therefore determined by the government's budget constraint rather than by the cost of resources.

5.2.3 Factor Supplies

The supply of land resources is taken to depend on nominal after-tax returns. This follows from the assumption that owners of these factors are not constrained to live in the same region where their assets are located. Hence, landowners will not be concerned with movements in the local price index, and will consider instead only the nominal return that can be earned by an asset. Land is also assumed to be sector-specific so that land resources cannot be transferred from one use (sector) to another.

For sectors one and two, the supply of sector-specific land is likely to be quite inelastic in the long run, as the margin of cultivation of agricultural land is extended and marginal resource deposits are exploited. In the service sector, however, the supply of land is likely to be increasingly elastic in the longer run as urban lands areas are extended into the surrounding flat plain areas. Equation (5.10) specifies the supply of sector-specific land to the region.

$$R_i = \overline{R}_i(rr_i(1 - tr_i))^{\gamma r_i} \qquad i = 1,2,5 \qquad \gamma r_i > 0 \tag{5.10}$$

where,

γ_r = the elasticity of resource land with respect to the rental rate

tr_i = the ad valorem tax on resource rent

rr_i = the before-tax rental rate of resource land

The supply of capital to the region is also assumed to depend on nominal after-tax returns. Capital is deemed to be sector-specific and highly responsive to movements in rental rates in the long run. Equation (5.11) specifies the supply of sector-specific capital to the region.

$$K_i = \overline{K}_i(rk_i(1 - tk_i))^{\gamma k_i} \qquad i = 1 \ldots 5 \tag{5.11}$$

where,

rk_i = the before-tax rental rate of sector-specific capital

tk_i = the ad valorem tax on sector-specific capital

γk_i = the elasticity of sector-specific capital with respect to the after-tax rental rate

To specify equilibrium in financial markets, it is assumed that they are efficient in the sense that rates of return to holding financial assets of equivalent risk are equalized. The price of financial assets is set equal to the present value of the flow of after-tax rental rates.

$$\frac{rr_i(1 - tr_i)}{\bar{i}} = FR_i \qquad i = 1,2,5 \tag{5.12}$$

$$\frac{rk_i(1 - tk_i)}{\bar{i}} = FK_i \qquad i = 1 \ldots 5 \tag{5.13}$$

where,

FR_i = price of financial assets based on resource land

FK_i = price of financial assets based on sector-specific capital

$\bar{i}$ = the exogenously determined interest rate

The supply of labour is assumed to depend on real wages in Alberta relative to those in regions from which labour can migrate to Alberta. It is relative real wages, rather than nominal wages, which are important, because workers will normally live and consume goods and services in the same region as the one in which they work. The elasticity of labour supply is assumed to be low in the

short run while becoming more elastic in the longer run. This elasticity will never be infinite even in the very long run. Monetary and psychic relocation costs will mean that some people will choose to reside in a certain region even given lower real wages in that region compared to those attainable elsewhere. Furthermore, increasingly restrictive immigration laws at the national level have probably reduced the elasticity of the aggregate labour supply within Canada. Real wages gross of the per capita levy (TL) enter the labour supply function since any effect of the per capita levy on labour supply is already accounted for in the aggregate price index (P). The price index is defined to include both publicly and privately produced goods.

$$L = \bar{L}\left[(W/P) \Big/ (\bar{W}/\bar{P})\right]^{\gamma_L} \qquad \gamma_L > 0 \tag{5.14}$$

where,

$(\bar{W}/\bar{P})$ = exogenous variables in sending region

W = money wage rate

P = price level

γ_L = elasticity of the labour supply with respect to real wage differentials

5.2.4 Prices, Income, and the Government Sector

The aggregate consumer price index, P, is calculated as the price of a basket of private and public goods consumed by a representative individual.

$$P = \sum_{i=3}^{6} P_i Q_i^R \tag{5.15}$$

where,

$P_i Q_i^R$ = the expenditure on the ith sector's output by a representative individual

The relevant prices for sectors three through five are the supply prices. For the government sector (sector six) it is the per capita levy (T_L) which is included in the price index.

Equation (5.16) defines total after-tax real income as the sum of labour income and the after-tax income of local capitalists and landlords divided by the price index. The apparent assymetry of the treatment of labour and other types of income is discussed below.

$$Y = \left[W \cdot L + \sum_{i=1}^{2,5} R_i' \, rr_i(1 - tr_i) + \sum_{i=1}^{5} K_i' \, rk_i(1 - tk_i) \right] / P \qquad (5.16)$$

Equation (5.16) treats the initial stock of capital and land as being locally owned.

The government budget constraint is specified so that government revenue must equal government expenditures plus saving. For convenience, it is assumed that all government revenues allocated to the HSTF are actually saved.

$$\sum_{i=1}^{5} (tk_i)(rk_i)(K_i) + \sum_{i=1}^{2,5} (tr_i)(rr_i)(R_i) + (TL)(L) = P_6X_6 + H \qquad (5.17a)$$

$$H = \alpha_H(tr1)(rr1)(R1) \qquad (5.17b)$$

where,

H = funds allocated to the Alberta Heritage Savings Trust Fund

TL = the per capita levy imposed on consumers of government services

α_H = proportion of resource tax revenue allocated to HSTF

It may be assumed initially that the government sets the tax rates on capital and land and then imposes a per capita levy on residents of an amount just sufficient to balance the budget. It is the per capita levy (TL) which is included as an argument in the demand equation for government goods and services, and which, therefore, influences the quantity of government output demanded. The amount of taxes that each resident will have to pay will depend upon the aggregate

demand for government output and also upon the amount of revenue received by the government in taxing capital and land. If there were no revenue from either land or capital then the per capita levy would have to equal the full per capita cost of providing the government output (that is, $TL = P_6$). With some revenue received from land or capital, the government will be able to reduce the per capita levy below the average cost of government output, so that the total levy for any particular volume of government output will decline. Whether the per capita levy actually falls as other government revenues increase depends on the price elasticity of demand for government output.

5.2.5 Savings, Investment, and the Balance of Payments

Equation (5.18) specifies domestic savings as being equal to the sum of government savings and savings from the income of labour, land and capital. The average and marginal propensities to save are assumed to be equal.

$$S = (aps_L)(W)(L) + (aps_{r1})(R1)(rr_1)(1 - tr1) + \sum_{i=2,5} (aps_{ri})(Ri)(rr_i)(1 - tri) + \sum_{i=1}^{5} (aps_{ki})(Ki)(rki)(1 - tki) + H \tag{5.18}$$

where,

aps_{xi} =the average propensity to save income out of factor x in sector i

Real after-tax disposable income (γD)available for expenditures on final demand goods and services is the difference between real income (γ) and real savings (S/P).

$$\gamma D = Y - S/P \tag{5.19}$$

Investment in the model, defined by equation (5.20), is the sum of expenditures on sector-specific capital and resources.

$$INV = \sum_{i=1}^{2,5} (FR_i)(R_i) + \sum_{i=1}^{5} (FK_i)(K_i) \quad (5.20)$$

It should be noted that equation (5.20) implies 100 percent depreciation of all assets in each time period. Assets are destroyed at the end of each period so that investment will be equal to the stock of assets in any one period. This assumption is consistent with the definition of income in equation (5.16) as the sum of the current incomes of labour, capitalists, and landlords and not including any appreciation of capital or resource assets. Savings is similarly defined in equation (5.18) as saving out of current income. The assumption of 100 percent depreciation is clearly unrealistic, particularly in relation to land assets. However, it is a simplifying assumption which is necessary in order to solve the rate of change format of the model in which all second and higher order derivatives are ignored.

Equation (5.21) states that savings must equal investment. A region may draw upon foreign savings if domestic savings are not adequate to finance the desired level of investment, or may invest abroad if domestic savings exceed investment opportunities.

$$INV = S + FSAV \quad (5.21)$$

where,

FSAV = the value of accomodating capital flow

The balance of payments of the regional economy is expressed in equation (5.22).

$$E - M - \sum_{i=1}^{5} (FK_i)(K_i) + FSAV + BOP = 0 \quad (5.22)$$

where,

E = the value of exports (domestic production less domestic consumption)

M = the value of imports (domestic consumption less domestic production)

BOP = an equilibrium short-term capital flow to satisfy the balance of payments constraint

Equation (5.22) reflects the fact that all sector-specific capital goods are imported; none are producing domestically. It should also be noted that the sole function of this equation is to determine the magnitude and direction of short-term capital flows. All other items in the equation are determined elsewhere in the model.

The specification of the 'levels' equations of the model is now complete. There are 46 endogenous variables in the model (W, rr_i, rk_i, P_i, R_i, K_i, L, X_i, Y, Y^D, S, TL, FR_i, FK_i, P, H, INV, $FSAV$, BOP) and 46 equations (5.2, .3, .4, .5, .6, .10, .11, .12, .13, .14, .15, .16, .17a, .17b, .18, .19, .20, .21, .22). Exogenous variables for the model include foreign prices of imports and exports, tax rates on capital and resources, various technical parameters, and the price of sector one's output.

In its present form, the system of equations could be solved for the values of endogenous variables which satisfy all equilibrium conditions. The initial equilibrium position could then be disturbed by introducing an increase in the relative price of energy or a change in tax policy, and the new set of equilibrium values of the endogenous variables could be calculated. The difference between the values of the two sets of endogenous variables gives an indication of the economic impact of the initial disturbance on the economy. However, such a procedure would involve solving 46 highly non-linear algebraic equations, and this would prove a difficult task. Alternatively, if it is assumed that the changes in the endogenous variables are small, the entire system can be converted into a

rate of change format by totally differentiating each of the equations in the model. Then, the proportionate changes required in each of the variables to maintain equilibrium given some initial exogenous shock can be calculated. This is equivalent to expanding the equations in a Taylor's series and neglecting second and higher order terms. Section 5.4 presents the rate-of-change form of the model.

5.3 Modifications to the Basic Model

The model presented in the previous section is specified according to the assumptions of 'case two' which incorporates an endogenous per capita levy into the budget constraint. For the other four cases, various modifications are introduced into the model in order to include different assumptions about government redistribution of rent, the nature of the labour supply function, and resource depletion.

Case three simulates the effect of adding the behavioral assumption that the labour supply depends on the real value of the Heritage Fund in addition to real wages. As the Heritage Fund grows, it may be hypothesized that labour would be attracted to the province in anticipation of future benefits to be received from the Fund as distributed by the provincial government. To incorporate this hypothesis in the model, equation (5.14) can be altered as follows:

$$L = \bar{L}\left[(W/P)\Big/(\bar{W}/\bar{P})\right]^{\gamma_L}\left[\frac{H}{P}\right]^{\gamma_H} \tag{5.14a}$$

$\frac{H}{P}$ = the real value of the Heritage Fund

γ_H = the elasticity of labour supply with respect to the real value of the Heritage Fund

γ_H is assumed to be very low (less than 1) in the short run and significantly larger in the long run.

In case four, the government is assumed to force the underpricing of natural resource feedstock to the primary manufacturing sector. For this case, equation (5.2) must be altered so that the price of intermediate inputs of sector one into sector three (P_{13}) will be reduced by a certain set subsidy (SB). In addition, the price received for a portion of sector one's output will have to be reduced by the same subsidy. Unit cost in sector one will now equal a weighted average of the price of sector one's output and that same price minus the subsidy (P_1 - SB). The unit cost equations modified for sectors one and three will appear as follows:

$$C^1(W, rr_1, rk1, P_{j1}) = (P1 - SB) \qquad j = 1...6$$

$$C^3(W, rr_3, rk3, P_{j3}, (P13 - SB)) = P3 \qquad j = 2...6$$

Case five simulates the impact on the regional economy of lowering taxes on capital. The budget constraint (equation (5.17)) is altered so that the per capita levy is set to equal the per capita cost of providing government services ($TL = P_6$). The tax on capital is then made the endogenous component within the equation.

Case one is the reference case in which all rents are assumed to accrue to the private sector. For this case the government sector is removed entirely from the model.

Finally, for each of cases one and two, one simulation is performed which incorporates a simple mechanism of resource depletion. These simulations are carried out in response to possible criticism of the specification of the supply of resource land to sector one. The supply of non-renewable resources, although inelastic, is assumed implicitly to be available in infinite quantities. Conse-

quently, when the price of sector one's output rises because of an exogenous price rise in world markets, rents received by capitalists in that sector will always increase. In reality, a price rise may not increase the value of rents obtained if the supply of resource inputs, and hence the output of sector one, are declining. A notion of resource depletion can be incorporated into the resource supply equation of sector one as indicated in equation (5.10a).

$$R_1 = \bar{R}1(rr1(1 - tr1)) - X1 \qquad (5.10a)$$

Equation (5.10a) specifies that the amount of resources consumed as X_1 is subtracted from the total quantity of resource available. This formulation has the desired effect of shifting the resource supply curve leftwards as the resource is consumed, and thereby reduces rents received in sector one. Of course, this notion of resource use still ignores the eventuallity of absolute depletion within the region of particular resources.

5.4 Rate-of-Change Form of the Model

The rate-of-change form for the equilibrium condition that unit cost equals price is

$$\theta_{iw}\dot{w} + \theta_{iR}\dot{rr}_i + \theta_{iK}\dot{rk} + \theta_{ij}\dot{P}_{ji} = \dot{P}_i \qquad i = 1\ldots6,\ j = 1\ldots6 \qquad (5.2')$$

where,

$$\dot{x} = dx/x$$

The parameter θ_{ix} represents the share of the value of a unit of output of sector i attributed to the input with factor price x, and is equal to $C^i_X(\cdot)X/P_i$.

The rate of change format for the full employment equations is

$$\theta^i_W\,\sigma^i_{wrr}\,\dot{w} + \theta^i_k\,\sigma^i_{rk\cdot rr}\,\dot{rk}_i - (\theta^i_W\,\sigma^i_{w\cdot rr} + \theta^i_k\,\sigma^i_{rk\cdot rr})$$
$$\dot{rr}_i + \dot{Q}_i - \dot{R}_i = 0 \qquad i = 1,2,5 \qquad (5.3')$$

$$\theta^i_W\,\sigma^i_W\,\dot{w} + \theta^i_R\,\sigma_{rk\cdot rr_i} - (\theta^i_W\,\sigma^i_{wrk} + \theta^i_{rr}\,\sigma^i_{rs\cdot rr})$$
$$\dot{rk}_i + \dot{Q}_i - \dot{K}_i = 0 \qquad (5.4')$$

$$-\left[\sum_{i=1,2,5} \lambda_i\,(\theta^i_R\,\sigma^i_{w\cdot rr}) + \sum_{i=1}^{6} \lambda_i\,(\theta^i_k\,\sigma^i_{wrk})\right]\dot{w}$$
$$+ \sum_{i=1,2,5} (\lambda_i\,\theta^i_R\,\sigma^i_{wrr})\,\dot{rr}_i + \sum_{i=1}^{5} (\lambda_i\,\theta^i_k\,\sigma^i_{wrk})\,\dot{rk}_i$$
$$+ \sum_{i=1}^{6} \lambda_i\,\dot{Q}_i - \dot{L} = 0 \qquad (5.5')$$

The parameter θ_{ik} is defined as before. σ^i_{KL} is the technical elasticity of substitution between factors with prices K and L in sector i. It is defined as $\sigma^i_{KL} = C^i(\cdot)C^i_{KL}/C^i_K(\cdot)C^i_L(\cdot)$ in terms of the unit cost notation used earlier. It is assumed that there exist no substitution possibilities between the primary factors (land, labour and capital) and purchased intermediate inputs. The parameter λ_i is the proportion of the total labour force employed in sector i.

The rates of change formulation for the demand equations are:

$$\dot{X}_i = S_{iF}\,\dot{Q}_i + S_{iE}\,\dot{NE}_i + S_{ij}\,\dot{X}_j \qquad i = 1\ldots6$$

$$S_{iF} + S_{iE} + S_{ij} = 1.0 \qquad (5.6')$$

where S_{iF} is the proportion of total production of the ith sector entered into final demand denoted by the subscript F, net exports (E), or intermediate use in sector j.

The rate of change form of the factor supply equations for sector-specific land and capital are

$$\dot{R}_i - \gamma_{ri}\left[\dot{rr}_i - \left(\frac{tr_i}{1-tr_i}\right)\dot{tr}_i\right] = 0 \quad i = 1,2,5 \qquad (5.10')$$

$$\dot{K}_i - \gamma_{ki}\left[\dot{rk}_i - \left(\frac{tk_i}{1-tk_i}\right)\dot{tk}_i\right] = 0 \quad i = 1\ldots5 \qquad (5.11')$$

The change in the value of financial assets derived from land and capital are provided by equations (5.12') and (5.13').

$$\dot{rr}_i - \left(\frac{tr_i}{1-tr_i}\right)\dot{tr}_i - FR_i = i \qquad i = 1,2,5 \qquad (5.12')$$

$$\dot{rk}_i - \left(\frac{tk_i}{(1-tk_i)}\right)\dot{tk}_i - FK_i = i \qquad i = 1\ldots5 \qquad (5.13')$$

The change in the supply of labour is given by (5.14').

$$\dot{L} - \gamma_L\left[(\dot{w} - \dot{P}) - \dot{w}^{RC}\right] = 0 \qquad (5.14')$$

where $\dot{w}^{RC}$ is the change in real wages in sending regions and is assumed to be zero for our purposes.

The consumer price index of the region in terms of rates of change is given by:

$$\dot{P} = \alpha_3\dot{P}_3 + \alpha_4\dot{P}_4 + \alpha_5\dot{P}_5 + \alpha_6\dot{TL} \qquad \sum_{i=3}^{6}\alpha_i = 1 \qquad (5.15')$$

where α_i is the share of the ith sector in the representative consumer's budget.

The change in after-tax real income derived from labour, capital and resources is

$$\dot{Y} - YL(\dot{L} + \dot{w}) - \sum_{i=1}^{2,5} YR_i(\dot{R}_i + \dot{rr}_i) + \sum_{i=1}^{2,5} YTR_i(\dot{tr}_i + \dot{R}_i + \dot{trr}_i)$$

$$- \sum_{i=1}^{6} YK_i(\dot{K}_i + \dot{rk}_i) + \sum_{i=1}^{6} YTK_i(\dot{tk}_i + \dot{K}_i + \dot{rk}_i) + \dot{P} = 0 \qquad (5.16')$$

where YX_i is the share of the ith factor in before-tax income, and YTX_i is the share of taxes in the income of the ith factor.

The rate of change form of the government's budget constraint is:

$$g_L(\dot{P}_6' + \dot{L}) + \sum_{i=1,2,5} g_{ri}(\dot{tr}_i + \dot{R}_i + \dot{rr}_i)$$

$$+ \sum_{i=1}^{5} g_{k_i}(\dot{tk}_i + \dot{K}_i + \dot{rk}_i) - g_e(\dot{P}_6 + \dot{X}_6) - g_h \dot{H} = 0$$

$$gL + \sum_{i=1}^{2,5} gr_i + \sum_{i=1}^{5} gk_i = 1$$

$$\sum_{i=e,h} g_i = 1 \qquad (5.17a')$$

where g_{xi} is the share of the x factor of the ith sector in government tax revenues and g_e and g_h are the shares of government expenditures allocated to producing government goods and services and to the Heritage Fund respectively.

The rate of change form of the Heritage Fund equation is

$$\dot{H} - \delta_H(\dot{rr}_1 + \dot{R}_1 + \dot{tr}_1) = 0 \qquad (5.17b')$$

where δ_H is the share of resource tax revenue allocated to the Heritage Fund.

The specification of savings and of domestic income in rate of change format is given by equation (5.18').

$$\dot{S} - \theta SL(\dot{W} + \dot{L}) - \theta SR1(\dot{R}1 + \dot{r}r1) + \theta StR1$$
$$(\dot{R}_1 + \dot{r}r1 + \dot{t}r1) - \sum_{i=2,5} \theta SRi(\dot{R}_i + \dot{r}r_i) + \sum_{i=2,5} \theta Str_i$$
$$(\dot{R}_i + \dot{r}r_i + \dot{t}r_i) - \sum_{i=1} \theta Sk_i(\dot{k}_i + \dot{r}k_i + \dot{t}k_i) +$$

$$\sum_{i=1}^{5} \theta Stk_i(\dot{k}_i + \dot{r}k_i + \dot{t}k_i) + \theta SH\,\dot{H} = 0 \tag{5.18'}$$

where θsx_i denotes the share of savings derived from the income of factor x in the ith sector, and θstx_i is the reduction in the share due to taxes on factor incomes in the ith sector.

Real disposable income in the rate of change format is as follows:

$$S_{YD}\,\dot{YD} = \dot{Y} - S_{SAV}(\dot{S} - \dot{P}) \tag{5.19'}$$

where S_{YD} and S_{SAV} are the shares of disposable income and saving in real income, respectively.

The specification of investment in capital assets in rate of change form is given by

$$\dot{INV} - \sum_{i=1,2,5} \theta IR_i(\dot{FR}_i + \dot{R}_i) - \sum_{i=1}^{5} \theta IK_i(\dot{FK}_i + \dot{K}_i) = 0 \tag{5.20'}$$

where θIx_i is the share of the xth financial asset of the ith sector in aggregate investment expenditures.

The savings and investment equality is as follows:

$$\dot{INV} - \delta S_D\dot{S} - \delta S_F F\dot{S}AV = 0 \tag{5.21'}$$

where δSI represents the share of total savings arising from domestic (D) and foreign (F)sources.

The balance of payments equations is specified in rate of change format according to equation (5.22') which for clarity is divided into seven parts.

$$\text{(a)} \quad BP_1 \left[(1 - S11)\dot{Q}1 + \dot{P}1 - (S12)\dot{Q}2 - (S13)\dot{Q}3 - (S14)\dot{Q}4 - (S15)\dot{Q}5 \right]$$

$$\text{(b)} \quad + BP_2 \left[(\tau_2 + 1)\dot{P}2 - \tau_2(\theta_{21})\dot{P}1 \right]$$

$$\text{(c)} \quad + BP_3 \left[(\tau_3 + 1)\dot{P}3 - (\tau_3)(\theta_{31})\dot{P}1 \right]$$

$$\text{(d)} \quad + BP_4 \left[(1 - v)(\tau_4 + 1)\dot{P}4 - 0.72(\tau_4)\theta_{41}\,\dot{P}1 \right]$$

$$\text{(e)} \quad + BP_4(v)\dot{INV}_K$$

$$\text{(f)} \quad + (BPBOP)\dot{BOP}$$

$$\text{(g)} \quad + (BPFSAV)\dot{FSAV} = 0 \qquad (5.22')$$

BP_i represents the shares of the output of sectors one through four in the balance of payments. BPBOP and BPFSAV represent the shares of short-term and long-term capital flows respectively in the balance of payments. $S1_i$ are the proportions of the total production of sector one going into intermediate demand in sector i. θ_{ix} are defined as in the unit cost equations (5.2'). τ_i are the price elasticity of export demand for the output of sector i. INV_K represents investment in capital goods only. The parameter v is defined as the portion of sector four goods which are classed as capital goods.

Part (a) of equation (5.22') defines the change in value of exports of sector one's output. It is specified as the residual after intermediate demand for sector one goods by sectors one through five. Parts (b), (c) and (d) specify exports of goods from sectors two, three and four respectively. Part (e) gives imports of capital goods which are classified as sector four type products. Parts (f) and (g) define changes in short and long-term capital flows respectively.

This completes the specification of the model in rate of change format. The system can be expressed in matrix form $Bf = a$, where 'B' is a matrix of technical coefficients of dimensions 46x46, 'f' is a 46x1 vector of endogenous variables and 'a' is a 46x1 vector of exogenous variables. Appropriate values

were chosen for the various parameters, as described in Appendix I. The system was then shocked by altering values of the vector 'a' to determine the required adjustment in each of the endogenous variables. The next chapter discusses the results of the simulations.

Chapter 6

SIMULATION RESULTS

6.1 Introduction

This chapter presents the simulation results that were obtained for five different rent distribution schemes discussed in Chapters 2 and 3 employing the model of Chapter 5. Each set of simulations consists of two separate estimates; the first is run under short run assumptions and the second under long run assumptions. In addition, in two of the cases a third estimate is presented which incorporates the notion of resource depletion in the long run. It will be recalled that for each of the short run simulations two exogenous shocks were applied to the system of equations. Firstly, the price of sector one's output (P_1) was made to rise by one percent. Secondly, demand for output from sector five (Q_5) was assumed to increase by one percent. For the long run simulations only the first exogenous shock was imposed.

The first set of simulations to be discussed (case one) shall be referred to as the 'staple boom' case. This case represents an economy where there is no government sector and all rents are privatized. Any services which would normally have been provided by the government are assumed to be supplied by the private sector on a user fee basis. The case examines the adjustment of a small open economy to an improvement in its terms of trade under free market conditions.

The second set of results (case two) simulates a government policy which uses resource rents collected through taxes to permit the reduction of the price charged to individuals for government goods and services (the per capita levy) below the unit cost of producing those goods and services. To incorporate this scenario into the model, the per capita levy is made endogenous within the

government's budget constraint.

The third set of simulations (case three) includes the per capita levy as the endogenous argument in the government budget constraint, as in the previous case, but also includes the real value of the Heritage Trust Fund as an argument in the labour supply equation. In effect, migrants are assumed to view the Fund as a common property and anticipate that they will receive some type of benefit from the Fund in the future.

The fourth set of simulations (case four) continues to treat the per capita levy as endogenous. In addition, output of the primary non-renewable sector used as intermediate input into primary manufacturing is assumed to be sold at less than market price. That is, the rest of the primary non-renewable sector's output is assumed to experience an exogenous price increase of one percent, but the primary manufacturing sector is insulated from this price increase. The purpose of this simulation is to analyze the impact of subsidizing the prices of certain local inputs (such as natural gas feedstock, for example) in order to stimulate certain types of industry within the region.

The final set of simulations (case five) assesses the consequences of making the tax on capital endogenous in the government budget constraint. In this case, the per capita levy is assumed to equal the unit cost of providing government output.

The next sections provide detailed simulation results for each of these cases in turn. A glossary of the variables to be discussed is presented in Table 6.1.

TABLE 6.1

VARIABLE GLOSSARY

$\cdot$	percent change in variable
$\dot{Q}_1$	output of non-renewable primary sector (sector one)
$\dot{Q}_2$	output of renewable primary sector (sector two)
$\dot{Q}_3$	output of primary manufacturing (sector three)
$\dot{Q}_4$	output of secondary manufacturing (sector four)
$\dot{Q}_5$	output of service sector, non-traded (sector five)
$\dot{Q}_6$	output of government sector (sector six)
$\dot{P}_2$	price of sector two
$\dot{P}_3$	price of sector three
$\dot{P}_4$	price of sector four
$\dot{P}_5$	price of sector five
$\dot{P}_6$	price of sector six
$\dot{R}_1$	resource input in sector one
$\dot{R}_2$	resource input in sector two
$\dot{R}_5$	resource input in sector five (urban land)
$\dot{K}_1$	sector-specific capital in sector one
$\dot{K}_2$	sector-specific capital in sector two
$\dot{K}_3$	sector-specific capital in sector three
$\dot{K}_4$	sector-specific capital in sector four
$\dot{K}_5$	sector-specific capital in sector five
$\dot{L}$	labour force
$\dot{RR}_1$	nominal return on resource input in sector one
$\dot{RR}_2$	nominal return on resource input in sector two
$\dot{RR}_5$	nominal return on resource input in sector five

TABLE 6.1 (Cont'd)

$\dot{RK}_1$	nominal return on sector-specific capital in sector one
$\dot{RK}_2$	nominal return on sector-specific capital in sector two
$\dot{RK}_3$	nominal return on sector-specific capital in sector three
$\dot{RK}_4$	nominal return on sector-specific capital in sector four
$\dot{RK}_5$	nominal return on sector-specific capital in sector five
$\dot{W}$	nominal wage rate
$\dot{P}$	consumer price index
$\dot{Y}$	after-tax income deflated by the consumer price index (P)
$\dot{Ys}$	after-tax income deflated by a price index which includes the social cost of government goods (P_6)
$\dot{TL}$	tax on labour (per capita levy)
$\dot{H}$	Heritage Savings Fund
FR_1	price of financial assets based on resource land in sector one
FR_2	price of financial assets based on resource land in sector two
FR_5	price of financial assets based on resource land in sector five
FK_1	price of financial assets based on sector-specific capital in sector one
FK_2	price of financial assets based on sector-specific capital in sector two
FK_3	price of financial assets based on sector-specific capital in sector three
FK_4	price of financial assets based on sector-specific capital in sector four
FK_5	price of financial assets based on sector-specific capital in sector five
$\dot{SAV}$	domestic savings
$\dot{YD}$	real disposable income
$\dot{BOP}$	short term (accomodating) capital flow
dBOP	absolute change in short term capital flow (millions of dollars)
$\dot{FSAV}$	foreign direct investment
dFSAV	absolute change in foreign direct investment (millions of dollars)

6.2 Case One: The Staple Boom

6.2.1 The Short Run

The results for the staple boom case in the short run are presented in Table 6.2. They appear to be generally as predicted in the theoretical discussions in Chapters 1 and 2. In the short run, the very inelastic factor supplies imply that production can expand in some sectors only at the expense of production in the others. Accordingly, we observe that the physical quantity of production has declined in every sector except the service sector. The value of production ($\dot{P}+\dot{Q}$) has declined in the non-renewable primary, renewable primary, and secondary manufacturing sectors, while increasing in the primary manufacturing and service sectors.

It is the service sector which shows the most significant increase in the value of its output (5.3 percent). This is not surprising since this sector faces the most income elastic and least price elastic demand for its output. As per capita income ($\dot{Y}-\dot{L}$) rises, which it does by 1.6 percent, demand for services rises more than proportionately. The price of service sector output rises, and the sector is able to bid capital and labour away from the other sectors leading to their contraction. Secondary manufacturing displays the greatest contraction in the value of its output. This sector faces a price elastic and income inelastic demand curve, and a very elastic supply of competing imports from outside of the region. As the wage rate for labour is bid up by the service sector, costs will rise for secondary manufacturing causing its output to become less competitive with respect to imports. Its supply curve shifts to the left and production contracts.

The remaining three sectors (one, two and three) experience changes in the value of their output which are less pronounced than in the service and secondary

TABLE 6.2

SIMULATION RESULTS
CASE ONE: THE STAPLE BOOM[1]

	Short[2] Run	Long[3] Run	Long Run[4] with depletion		Short[2] Run	Long[3] Run	Long Run[3] with depletion
Q_1	-1.2	2.8	1.3	RK3	-1.9	0.0	0.0
Q_2	-1.6	0.0	0.2	RK4	-11.5	0.0	0.0
Q_3	-0.7	0.7	0.7	RK5	7.4	0.0	0.0
Q_4	-3.3	-0.7	1.3	W	4.4	0.1	0.2
Q_5	1.4	0.4	1.1	P	1.9	0.1	0.2
P_2	1.5	0.1	0.2	Y	1.9	1.0	1.3
P_3	1.8	0.3	0.3	FR1	-1.8	4.1	4.0
P_4	-0.1	0.1	0.2	FR2	-1.8	0.1	0.2
P_5	3.9	0.2	0.2	FR5	4.1	0.2	0.5
R_1	-0.9	2.1	0.6	FK1	-3.6	0.0	0.0
R_2	-0.9	0.1	0.2	FK2	-3.6	0.0	0.0
R_5	2.1	0.4	1.1	FK3	-1.9	0.0	0.0
K_1	-0.4	3.3	1.8	FK4	-11.5	0.0	0.0
K_2	-0.4	0.1	0.2	FK5	7.4	0.0	0.0
K_3	-0.2	0.7	0.7	SAV	2.7	1.5	1.6
K_4	-1.2	-0.7	1.3	YD	2.2	0.9	1.2
K_5	0.7	0.5	1.1	BOP	-7.5	8.9	3.7
L	0.3	0.4	0.9	dBOP	130.05	-154.33	-64.16
RR_1	-1.8	4.1	4.0	FSAV	4.5	0.0	0.5
RR_2	-1.8	0.1	0.2	dFSAV	-65.79	0.0	-7.31
RR_5	4.1	0.2	0.5	Y-L	1.6	0.6	0.4
RK_1	-3.6	0.0	0.0	W-P	2.5	0.0	0.0
RK_2	-3.6	0.0	0.0				

1 All values are given as percentage changes (i.e. $\dot{x} = (dx/x) \cdot 100$) except for dBOP and dFSAV which are in millions of dollars.

2 Labour supply elasticity = 0.1. Sector-specific capital supply elasticity (sectors 1,...,5) = 0.1. Resource supply elasticity (sectors 1,2,5) = 0.5.

3 Labour supply elasticity = 200. Sector-specific capital supply elasticity (sectors 1,...,5) = 400. Resource supply elasticity: sector 1 = 0.5, sector 2 = 1.0, sector 5 = 2.0.

manufacturing sectors. Primary manufacturing shows a one percent increase in value of output as a result of a 0.7 percent decline in output along with a 1.8 percent increase in price. This sector fares better than does secondary manufacturing because the demand for its output is inelastic rather than elastic with respect to price, and because there is no highly elastic supply of imported substitutes for its output. Finally, it may be observed that both the primary renewable and non-renewable sectors experience very small (0.1 percent and 0.2 percent respectively) declines in the value of their output.

Turning to the supplies of sector-specific land and resources ($\dot{R}_1$, $\dot{R}_2$, $\dot{R}_3$), we see that the results are generally consistent with the changes in sectoral prices and outputs just discussed. Land used in primary renewable and non-renewable resource activities contracts as production in these sectors declines. Land used in the service sector increases as does that sector's production. The supplies of sector-specific capital ($\dot{K}_1$, $\dot{K}_2$, $\dot{K}_3$, $\dot{K}_4$, $\dot{K}_5$) behave likewise, decreasing in all sectors except the service sector. The supply of labour ($\dot{L}$) is found to increase somewhat (0.3 percent).

Looking at the results for the returns to sector-specific capital (RK_1, RK_2, RK_3, RK_4, RK_5) and for the prices of financial assets based on sector-specific capital (FK_1, FK_2, FK_3, FK_4, FK_5) we observe that percentage changes shown are the same for both variables in comparable sectors. This is, of course, the result of the fact that both the interest rate and taxes on capital have been assumed constant in the model. The supply of sector-specific capital is assumed to depend on after-tax returns which in the case of a constant interest rate and constant taxes is equal to the prices of related financial assets. In each of the sectors where production has declined (sectors one through four), we observe that after-tax returns have also declined. This is a consequence of the bidding

away of labour from these sectors which reduces the productivity of capital and therefore its return and also the price of related financial assets. Not surprisingly, the return (or financial asset price) to capital in secondary manufacturing declines the most as this is the sector which is least able to compete for labour. The service sector experiences a relatively large increase in the return to sector-specific capital. The same qualitative results also hold for the changes in returns to sector-specific land inputs which again are equal to the changes in the prices of financial assets based on resource land. The return to land in the primary resource sectors declines, while that in the service sector shows an increase in return. These outcomes imply that in the short run there has been a transfer of income to the owners of sector-specific capital and land in the service section from the owners of factors in other sectors. It may be noted that we are concerned with nominal (RR_i and RK_i) rather than real (($RR_i - \dot{P}$), ($RK_i - \dot{P}$)) returns to land and capital because of our assumption that owners of these factors are not constrained to live in the same region in which their assets are located. Thus capitalists are assumed to respond to nominal returns in the region rather than real.

The increase in demand for labour under the assumption of inelastic factor supplies results in nominal wages being bid up by 4.4 percent and real wages ($\dot{W}-\dot{P}$) by 2.5 percent. Real income ($\dot{Y}$) increases by 1.9 percent mainly as a result of increased rents in the service sector and increased real wages. It should be observed that intersectoral reallocations in income (such as from the owners of sector-specific land in the primary resource sectors to the owners of sector-specific land in services) are in fact greater in magnitude than the overall change in regional income.

In order to accomodate increased investment in the economy, savings must

increase. Accordingly, we observe that domestic saving increases by 2.7 percent. The value for the percentage change in foreign saving ($\dot{FSAV}$) is 4.5. Referring to Appendix I (page 166) it will be observed that the initial value for FSAV is a negative number (-$1462 million). This implies that at the initial point in time the region was experiencing a long-term capital outflow. A positive value for the percentage change in FSAV implies that there has been an increase in the amount of capital outflow. The region is exporting more capital, implying that the increase in domestic saving has been more than sufficient to accomodate the increased investment. The absolute increase in capital outflow has been calculated as $65.79 million.

The percentage change in short-term capital flows ($\dot{BOP}$) is -7.5. This decline for $\dot{BOP}$ indicates that the original short-term capital outflow of $1734 million has been reduced. The actual change has been calculated to be $130.05. A reduced short-term capital outflow implies that the value of imports to the region has increased more than the value of exports from the region. This is as would be expected given the increase in imports of secondary manufacturing and the decline in production of export commodities.

6.2.2 The Long Run

The results for the staple boom in the long run are also presented in Table 6.2. These results differ quite dramatically from those of the short run. With the economy facing highly elastic supplies of labour and capital, the primary non-renewable resource sector is able to expand by drawing on factors from outside the region rather than from those involved in competing uses within the region. The sector shows an increase in production of 2.8 percent. The renewable resource sector shows no change in production while the service

sector increases output by 0.4 percent. The quantity of output produced in the primary manufacturing sector increases by 0.7 percent and, with a price rise of 0.3 percent, the value of output produced increases by a small amount. The only sector to show a drop in production is secondary manufacturing where the quantity produced declines by 0.7 percent, while the price shows a small increase of 0.1 percent. These results appear to be precisely as predicted in chapter 1 for the long run results of a staple boom - the economy has become more specialized in primary non-renewable resource production.

These sectoral changes can be accounted for by considering the value of various elasticities as well as the changes that have occurred in real income, wages and the labour force. The labour force shows a small increase in size (0.4 percent). At the same time, nominal wages have increased by 0.1 percent, as well as has the price index, so that the real wage $(\dot{W}-\dot{P})$ has remained approximately constant. Real after-tax income has increased by 1.0 percent while real income per capita has increased by 0.6 percent.

The small decline that occurs in the output of secondary manufacturing is a result of the price elastic demand for its output and the elastic supply of competing imports available from outside the region. The bidding up of nominal wages by 0.1 percent will put this sector at a slight disadvantage in relation to competing external suppliers of imports who have experienced no rise in their own wage costs. The slight rise in the price of secondary manufacturing output (partly in response to higher wage costs) will adversely affect the quantity of domestic output demanded while the demand for imported output will increase, given the price elastic nature of the demand curve faced by this sector. The increase in per capita income noted earlier, will offset these adverse results somewhat by increasing demand, but it cannot do so entirely because demand for

secondary manufactured goods is assumed to be income inelastic. The larger labour force will also cause some increase in domestic demand. For these reasons secondary manufacturing shows only a small decline in output.

The remaining sectors (two, three and five) all show changes in output which depend similarly on the assumed elasticities. The service sector experiences an increase in the quantity of production in part because of the increase in the labour force and in per capita income. It fares better than secondary manufacturing because being a non-traded good it does not face competition from imports, and, in addition, demand for its output is income elastic. Sector two, an export sector, shows no appreciable change in output. Sector three experiences a small increase in output and price. The increase in price must, in part, be caused by the increase in price of one of its major intermediate inputs - output from the primary non-renewable resource sector. This price increase does not make manufacturing's output less competitive in world markets since it is a worldwide and not just a regional phenomenon.

Turning to the supplies of sector-specific resource land, it will be observed that these behave precisely as in the short run version - increasing the most where production shows the largest increase. The return to resource land likewise increases by most in the primary non-renewable sector although owners of immobile factors in each of the three sectors experience some increase in return. For reasons noted previously, the percentage changes in the prices of financial assets based on resource land are precisely the same as the percentage changes in the returns to resource land.

The supplies of sector-specific capital also increase in those sectors where production has increased. The returns to sector-specific capital, as well as the price of financial assets based on sector-specific capital, are observed to remain

roughly unchanged. This is as would be expected given our assumption of highly elastic factor supplies. Real wages ($\dot{W}$-$\dot{P}$) have been observed to remain approximately unchanged for the same reason.

Turning to savings, it will be observed that to accomodate increased investment, domestic saving has increased by 1.5 percent. Foreign saving shows no change. Domestic savings alone has been sufficient to accomodate domestic investment.

The positive value of 8.9 percent indicated for the percentage change in the balance of payments ($B\dot{O}P$) implies that there has been an accomodating short-term capital outflow. This outflow has been calculated as 154.33 million dollars. This, in turn, implies that the change in the value of exports has exceeded the change in the value of imports to the region. This scenario agrees with our previous theoretical discussions. In the long run portion of a staple boom, sufficient investment in the staple sector will have had time to occur so that increased production for export can take place.

6.2.3 The Long Run with Depletion

If we compare the long run results for the staple boom with and without the depletion mechanism, we see that, except for sector four, the difference between the two consists mainly of small changes in magnitude. Because resource rents in sector one do not increase by as much in the depletion case, expansion of output in that sector is only by 1.3 percent rather than by 2.8 percent in the non-depletion case. Each of the other sectors shows a larger increase in output in the depletion case. Secondary manufacturing actually shows an increase in production of 1.3 percent, compared to the previous 0.7 percent decline. The service sector expands production by 1.1 percent, com-

pared with the previous 0.4 percent increase. Renewable resources also expands production where no change was indicated before. These results arise because of the assumption of a positive elasticity of substitution ($\sigma = 0.5$) among the primary factors land, labour, and capital. The depletion mechanism causes the supply of non-renewable resources to shift leftwards. As a consequence, labour and capital will be increasingly substituted for resource land in sector one. In effect, the non-renewable resource sector becomes more labour intensive resulting in an increased influx of labour to the region. A larger labour force creates an increase in demand for locally produced goods. The somewhat paradoxical result is that while sector one is unable to expand as much in the depletion case, the other sectors experience more growth than in the non-depletion case.

It will be noted that aggregate income increases by 1.3 percent in the depletion case while increasing by only 1.0 percent in the non-depletion case. However, real per capita income increases by less in the depletion case than in the non-depletion case (depletion: 0.4 percent, non-depletion: 0.6 percent). Thus, when the depletion mechanism is included per capita income increases by less, but aggregate income increases by more than when no depletion is included. In short, the reduced resource rents, implied by the inclusion of the depletion mechanism, result in a less intense shift towards specialization in primary non-renewable resource sector following an improvement in the terms of trade than in the case where depletion is ignored.

6.3 Case Two: The Government Sector with an Endogenous Per Capita Levy

6.3.1 The Short Run

The effects of permitting the per capita levy to be endogenous in the model are shown in Table 6.3. There are few significant differences between this simulation and that of the classic staple boom. The service sector expands by somewhat less and the other sectors contract by slightly less than in the previous case. In sector one we see that output declines by 0.4 percent resulting in an overall increase in the value of output of 0.6 percent, compared with the 0.2 percent decline in the value of output in the previous case. Sectors two, three and four show changes in the value of output of the same sign but of reduced magnitude compared to the previous case. The government sector, not included in the staple boom, here decreases the quantity of output by 1.5 percent, but an increase in the average cost of providing that output (P_6) leads to an overall increase in the value of output of 0.6 percent.

These short run results depict circumstances similar to those of the pure staple boom. The expansion of sector one in response to the increase in its price is constrained by inelastic supplies of labour and capital. The increase in per capita income that results from the improvement in the terms of trade increases overall demand for goods and services within the region and, in particular, increases demand for income elastic goods of the service and manufacturing sector. These changes in demand are accomodated mainly through intersectoral reallocations of labour. As before, it is the service sector which can most easily bid labour away from other sectors to expand production, because its output is non-traded and its price is able to rise without danger of inducing imports. Consequently, the service sector expands at the expense of the other sectors

TABLE 6.3

SIMULATION RESULTS
CASE TWO: THE GOVERNMENT SECTOR WITH AN ENDOGENOUS PER CAPITA LEVY[1]

	Short[2] Run	Long[3] Run	Long Run[3] with depletion		Short[2] Run	Long[3] Run	Long Run[3] with depletion
Q_1	-0.4	-1.7	-1.6	RK4	-5.3	0.0	0.0
Q_2	-1.0	1.4	1.8	RK5	4.4	0.0	0.0
Q_3	-0.5	3.3	4.2	W	2.5	3.1	4.1
Q_4	-1.6	34.9	45.1	P	1.6	3.0	4.0
Q_5	0.8	9.8	12.3	Y	0.6	6.4	8.0
Q_6	-1.6	1.2	0.9	Y^S	0.5	7.1	9.0
P_2	0.9	2.0	2.6	TL	1.9	6.2	8.4
P_3	1.1	1.8	2.3	H	-0.2	-1.0	-1.5
P_4	0.3	2.0	2.6	FR1	-0.4	-2.3	-4.4
P_5	2.3	2.6	3.4	FR2	-1.1	1.5	1.9
P_6	2.2	2.7	3.5	FR5	2.4	4.9	6.2
R_1	-0.2	-1.1	-0.5	FK1	-0.9	0.0	0.0
R_2	-0.5	1.5	1.9	FK2	-2.1	0.0	0.0
R_5	1.2	9.8	12.4	FK3	-1.4	0.0	0.0
K_1	-0.1	-1.8	-1.8	FK4	-5.3	0.0	0.0
K_2	-0.2	2.0	2.5	FK5	4.4	0.0	0.0
K_3	-0.1	3.6	4.6	SAV	0.6	8.0	10.1
K_4	-0.5	35.3	45.6	YD	1.0	6.8	8.5
K_5	0.4	10.5	13.3	BOP	0.9	-36.7	-46.5
L	0.1	8.1	10.2	dBOP	-15.61	636.38	806.31
RR_1	-0.4	-2.3	-4.4	FSAV	-4.2	12.6	16.5
RR_2	-1.1	1.5	1.9	dFSAV	61.4	-184.21	-241.23
RR_5	2.4	4.9	6.2	Y-L	0.5	-1.7	-2.2
RK_1	-0.9	0.0	0.0	Y^S-L	0.4	-1.0	-1.2
RK_2	-2.1	0.0	0.0	W-P	0.9	0.1	0.1
RK_3	-1.4	0.0	0.0	TL-P6	-0.3	3.5	4.9

1 All values are given as percentage changes (i.e. $\dot{x} = (dx/x).100$) except for dBOP and dFSAV which are in millions of dollars.

2 Labour supply elasticity = 0.1. Sector-specific capital supply elasticity (sectors 1,...,5) = 0.1. Resource supply elasticity (sectors 1,2,5) = 0.5.

3 Labour supply elasticity = 200. Sector-specific capital supply elasticity (sectors 1,...,5) = 400. Resource supply elasticity: sector 1 = 0.5, sector 2 = 1.0, sector 5 = 2.0.

with secondary manufacturing being most adversely affected, for reasons already discussed.

It is the presence of a government sector with its powers of taxation and spending which accounts for the less extreme shifts in output that occur in this case compared to the staple boom case. Perhaps the most obvious impact of the government sector is to cause a reduction in the real income which will be received by labour and the owners of capital and land resources because of the imposition of taxes on these factors. Looking at Table 6.3, we see that real income (after-taxes) ($\dot{Y}$) increases by 1.3 percentage points less in the endogenous per capita levy case than in the staple boom. Similarly, per capita real income ($\dot{Y}-\dot{L}$) increases by 0.5 percent in the present case, as opposed to 1.6 percent in the former case. The smaller increase in per capita (after-tax) real income leads to a smaller increase in the demand for goods and services. Consequently, upward pressure on nominal wages is reduced, and sectors other than the service sector are able to maintain production at a higher level than in the staple boom case.

It should be noted that real after tax income (Y) has been deflated by the consumer price index (P) which incorporates the cost to consumers of receiving government goods and services as measured by the per capita levy (TL). A price index which measures the social cost of providing government goods and services, rather than the price charged to consumers, would include the average per unit cost to government of providing government output (P_6) rather than TL. Real after-tax income deflated by this social price index is shown in Table 6.3 as Y^S. In the short run, Y^S has risen by one percentage point less than Y because the average cost of government output (P_6) has risen by more than the per capita levy.

The govenment sector acts as a moderating influence on the economy in the short run. Its taxation of a certain portion of the returns to factors means that rents in the service sector will not increase by as much and less 'over-heating' of the economy will occur. It is therefore reasonable that in this case, compared to the staple boom, nominal wages have increased by less (2.5 percent compared to the previous 4.4 percent), the price index has risen by less (1.6 percent as opposed to 1.9 percent), and the labour force has expanded by less (0.1 percent as opposed to 0.3 percent). Real wages have also risen by a smaller amount: 0.9 percent in this case compared to 2.5 percent in the staple boom.

To further our understanding of the short run case we must consider what has happened to the endogenous per capita levy ($\dot{TL}$) relative to the cost of providing government services ($\dot{P}_6$). In Table 6.3 it can be seen that both $\dot{P}_6$ and $\dot{TL}$ have risen, but that $\dot{P}_6$ has increased by the larger amount ($\dot{TL} - \dot{P}_6 = -0.3$). This means, in effect, that labour is being subsidized in its consumption of government services. The cost of providing government services has risen by more than the levy charged to pay for these services. The source of this implicit subsidy to labour is the increased tax receipts from the other factors of production - capital and land. In this instance, only factors of production specific to the service sector show increased returns which would increase the government's tax receipts.

The pricing of government services at less than their opportunity cost affects the supply of labour through its impact on the cost of a representative bundle of consumer goods. The cost to the individual of publicly-provided goods is included in the aggregate price index ($\dot{P}$). In this short run case the price index ($\dot{P}$) rises by less than if individuals were charged the full opportunity cost of their consumption of government services. Since labour responds to real wage

differentials between regions, the extent to which the price index rises will influence the amount of labour migration. This effect is not strong in the short run case, however since the labour supply curve is assumed highly inelastic.

The results for the remaining variables are predictable. We see that supplies of sector-specific land and capital increase only in the service sector. Likewise, the returns to these factors and the prices of related financial assets decline in all but the service sector. This decline in factor returns in four sectors occurs because the service sector bids labour away from all other sectors. The rise in capital/labour and land/labour ratios cause the productivity of land and capital in these sectors to decline.

The Heritage Savings Trust Fund declines by 0.2 percent in this short run scenario as a result of the decline in rents in the primary non-renewable sector. Private domestic saving increases by 0.6 percent. As explained in the staple boom case, the -4.2 percent change in foreign saving actually implies a decline in the original outflow of long-term capital of 1462 million dollars by 61.40 million dollars. Thus, increased investment has been permitted by an increase in domestic savings and a decline in the outflow of long-term capital. Accomodating short-term capital flows ($B\dot{O}P$) indicate that there has been a 15.61 million dollar increase in the previous outflow of 1734 million dollars. This would seem to imply that the change in the value of exports has exceeded the change in the value of imports. This result is unlike that which occurred in the staple boom case in the short run. This result, however, is not surprising for several reasons. Firstly, the value of exports has increased by more in the present case than in the staple boom case. This is caused mainly by the smaller decline in sector one's production in the current case. Secondly, the sector whose output can be readily replaced by imports (sector four) experiences a smaller decline in the

quantity and value of its production in the present case. Thirdly, the one sector which does expand production - the service sector - expands by a smaller amount in the present case. Consequently, imports of capital goods required for service sector expansion will be less than in the staple boom case.

6.3.2 The Long Run

The long run results presented in Table 6.3 differ greatly both from the short run results of the current case and the long run results for the staple boom. The incorporation of an endogenous per capita levy in the model under the assumption of highly elastic factor supplies has caused a significant amount of industrial diversification in the regional economy. This contrasts markedly to the increased specialization in primary non-renewable resources that occurred in the long run staple boom. All sectors in the present case, except for primary non-renewable resources, show an increase in the value of their production. Secondary manufacturing and the service sector show the most dramatic changes with both price and quantity increases causing the value of production to increase by 36.9 percent in the former and 12.4 percent in the latter. The primary non-renewable resource sector is the only one to show a decline in the value of its output due to a decrease of 1.7 percent in the quantity of production.

It is evident that the highly elastic supplies of labour and capital are necessary to permit this strong expansion in the industrial and the service sectors. To explain why these results differ so sharply from those of the long run staple boom, we must again consider the effects of the inclusion of the government sector. From Table 6.3, we see that the per capita levy (TL) imposed by the government has increased by 6.2 percent while the average cost of government services ($\dot{P}_6$) has increased by only 2.7 percent. In order to balance

its budget, the government has had to increase the charge for its services by more than the amount that the costs of providing those services have risen. This does not imply, however, that subsidization of labour's consumption of government goods and services has been eliminated. With a reduction in tax revenues received from other factors (in this case from land in primary non-renewable resources) the level of subsidization of labour has simply had to be reduced. As long as at least some revenue is received from factors other than labour, the endogenous budget constraint ensures that labour is paying less than the per unit cost of providing government services.

Elastic factor supplies and an endogenous per capita levy provide the basis for an intuitive explanation of the sectoral output changes in this case. Initially, the exogenous price increase for the output of the primary non-renewable resource sector will cause rents in that sector to be increased. The government's tax revenue from this sector will increase, and in order to balance its budget the government will have to reduce the per capita levy. The lowering of the per capita levy will cause a decrease in the general price index which will increase real wages within the region temporarily. Fiscally induced migration, as described in chapter 2, will then result until nominal wages have been bid down to the point where real wages are restored to their former level. The lower nominal wages will cause firms to expand production - paricularly those of the most labour intensive sectors, secondary manufacturing and services. Consequently, we would expect to see at this point a more industrially diverse economy with lower nominal wages than previously.

The migration of labour to the region in response to the lowering of the generalized price index will increase demand for locally produced goods and services. This will result in price increases directly in those sectors which supply

local markets and indirectly in those sectors which provide intermediate inputs to the sectors producing for final demand. Accordingly, we observe price increases in all sectors, with the largest increases for the private sectors appearing in the service sector (2.6 percent) and secondary manufacturing (2.0 percent). This latter price increase in secondary manufacturing is able to occur because the increase in the region's population means that demand for both domestic production and imports has increased. Since the supply curve of imports is upward sloping to the region, increased imports will come in at higher prices. The price of domestic output is therefore able to rise, and local production is expanded.

These generalized price increases imply an increase in the overall price index. If nominal wages did not increase in conjunction with the increasing price index, real wages would fall and labour would leave the region. At the same time, it is the rising prices of the various sectors' outputs which permit firms to pay increased nominal wages so that the industrial expansion which has occurred will not be totally eroded. We have already observed that every sector, except for sector one, is ultimately able to maintain an increased level of production to some degree. The price index and the nominal wage rate are observed to rise by 3.1 and 3.0 percent respectively so that real wages remain approximately constant, as must be the case in this situation of highly elastic labour supplies. The labour supply increases overall by 8.1 percent.

Only those sectors which can afford to pay increased nominal wages will be able to sustain the growth that occurred as a result of the original influx of labour. The primary non-renewable sector whose price is set completely exogenously cannot afford to expand production using the more expensive labour because of the limited 1.0 percent price increase. This sector is further

restrained by the fact that the supply of sector-specific resource land to it is assumed to be inelastic even in the long run. Thus we see a 1.7 percent decline in its output.

Turning to saving, government saving in the form of the Heritage Fund has declined by 1.0 percent. This decline is the result of falling resource rent in the primary non-renewable sector. Overall domestic saving has increased by 8.0 percent. The original outflow of long-term capital (dFSAV) has increased by some 184.21 million dollars. Short-term capital outflows (dBOP) have been reduced, in this case by 636.38 million dollars. This change in accomodating short-term capital flows indicates that imports have increased more than have exports. This follows from the contraction in production in an important export sector - primary non-renewable resources. Furthermore, demand for imports of secondary manufacturing will have increased with the increasing population.

In summary, the long run result of the endogenous per capita levy is significant extensive growth and industrial diversification within the open regional economy. The growth is extensive rather than intensive as real income ($\dot{Y}$) increases by 6.4 percent compared to the 1.7 percent decline in per capita real income ($\dot{Y}-\dot{L}$). Because TL has risen by a greater amount than P_6, it will be observed that Y^S (income deflated by social costs of production) has increased by more than Y. Thus when real income is measured by Y^S the decline in per capita real income (Y^S-L) is not as great (-1.0 percent). Interesting distributional consequences of this case are readily observable. The owners of fixed factors in the primary renewable and the service sector find their nominal returns have increased by 1.5 percent and 9.8 percent respectively. Real returns ($\dot{RR}_i$ - $\dot{P}$) have increased only in the service sector (6.8 percent), declining by 1.5 percent in primary non-renewable resources. Owners of fixed factors in the primary non-

renewable sector suffer losses as the return to their factor declines in both nominal (-1.1 percent) and real (-1.6 percent) terms. This scenario is precisely the reverse of the outcome observed in the long run staple boom. There the owners of resources in the primary non-renewable sector experienced an increase in the nominal and real rate of return to their factor. The nominal returns to the mobile factor capital remain largely unchanged in the present case. This result is consistent with the assumption of elastic factor supplies. The real return to labour (W-P) remains approximately constant for the same reason.

It may be concluded that a province-building strategy based on implicit subsidies to labour using rents from immobile factors can be highly successful in achieving the long run goal of economic diversification. However, this diversification is obtained only at a cost which can be measured in terms of foregone real per capita income. In the present case, we have observed a decline in real per capita income of 1.7 percent. This compares with an increase in real per capita income of 0.6 percent in the classic staple boom. The decline in real per capita income under the long-term province-building strategy is consistent with the discussion in chapter 2 of the likely consequences of province-building. From an efficiency standpoint, the implicit subsidy to labour has in effect caused too much labour migration to the province. It may be implied that the marginal product of labour within the region has been depressed below that which is achieved outside the region. A redistribution of labour out of the region to where its marginal product is higher would increase per capita income within the region. It should be re-emphasized, however, that the efficiency losses caused by province-building strategies have not harmed all residents of the province. As noted above, those who benefit most notably are the owners of land in the service sector.

6.3.3 The Long Run with Depletion

When the depletion mechanism is incorporated into the model, we observe from Table 6.3 that an even greater degree of industrial diversification occurs in the economy than in the long run simulation without depletion. Sectors two through five all increase production by a larger amount here than in the non-depletion case - with the most dramatic increase of 45.1 percent occurring in secondary manufacturing. As before, we observe a decline in the output of primary non-renewable resources. Production in the government sector increases by a smaller amount in the depletion case - 0.9 percent rather than 1.2 percent. In addition, we observe that prices in sectors two through six increase by more in this than in the non-depletion case.

These results are easily explained by observing how depletion affects the government's pricing of public goods. The imposition of depletion causes a leftward shift in the supply curve of primary resource output. Consequently, rents in this sector will be reduced further with the depletion mechanism imposed than without. The larger reduction in return to primary non-renewable resource land implies that in order to balance its budget the government must raise the per capita levy by a greater amount than when depletion is not considered - in this instance by 8.4 percent instead of 6.2 percent. The average cost of providing government services ($\dot{P}_6$) has risen by 3.5 percent in the present case compared with only 2.7 percent in the non-depletion case. Subsidization of labour by other factors is evidently smaller in the depletion case.

The larger increase in the per capita levy in the depletion case would be expected to reduce demand for government output. Furthermore, the cross-price elasticity of demand between government output and that of secondary manufacturing is assumed to be positive and greater than one (1.25). Therefore,

when the price of government output rises relative to the price of secondary manufacturing, consumers will shift consumption away from the government sector to secondary manufacturing. This explains in part why secondary manufacturing expands by more in the depletion case.

The generally larger amount of diversification in the depletion case is also explained by the positive elasticity of substitution between primary factor inputs, as was discussed in case one.

The remaining variables in the long run depletion case behave generally as expected. Looking at the distributional consequences within the economy, we see that the owners of fixed factors in the primary non-renewable sector find the nominal rate of return on their property decline by even more than in the non-depletion case. Likewise, owners of fixed factors in the renewable primary and service sectors find their nominal returns increase by an even larger degree. Overall, we see that more extensive growth has occurred in the depletion case. Aggregate real after-tax income ($\dot{Y}$) increases by 8.0 percent compared with the previous 6.4 percent. However, per capita real after-tax income declines by more in the depletion than in the non-depletion case (2.2 percent compared to 1.7 percent).

6.4 Case Three: Labour Supply Responds to Heritage Trust Fund

6.4.1 The Short Run

The simulations of case three differ from those of case two in that the former includes the real value of the Heritage Fund as an argument in the labour supply equation in addition to real wages. Because of the similarity between the two cases, explanation of the results of case three will be kept fairly brief.

It will be recalled that the size of the Heritage Trust Fund depends on the return earned in the primary non-renewable resource sector. Thirty percent of the tax revenues derived from resource land in this sector is allocated to the Fund. Any change in the real value of the Heritage Fund ($\dot{H}-\dot{P}$) will cause the labour supply curve to shift rightwards or leftwards and will thereby impact upon other variables within the system. In the short run it is assumed that labour's response to changes in the Heritage Fund is highly inelastic (GAMLH = .1).

Looking at the short run results of case three (Table 6.4) returns to owners of land in the primary non-renewable resource sector have declined. This decline results in a 0.2 percent decrease in the amount of revenue going into the Heritage Fund. Combined with the 1.6 percent increase in the price index ($\dot{P}$), the real value of the Fund has decreased by 1.8 percent. This will produce a leftward shift in the highly inelastic short run labour supply function. Labour will be in even shorter supply in the present case than in case two in the short run. Nominal wages would be expected to be bid up even higher. Our results show a slight decrease labour supply whereas there was an increase of 0.1 percent in case two. Nominal wages in the current case increase by 2.7 percent compared with 2.5 percent in case two. The tighter labour supply situation also causes real wages to increase by a slightly larger amount (1.1 percent compared with 1.0 percent).

The repercussions of the more restricted labour supply situation are generally as would be anticipated. Sectors three and four have experienced declines in production that are slightly larger than in the short run version of case two. The service sector (sector five) has expanded its production by less than in case two, while the primary resource sectors show declines of roughly the same magnitude. Sectoral price increases will be observed to be approximately

the same as those occurring in case two. Although higher nominal wage demands might be expected to influence prices upwards, this will be counter balanced by the effect of lower output levels.

Given the relative movements in sectoral prices and outputs and the constant size of the labour force, the rest of the results follow logically. It should be noted that aggregate income has increased by marginally less in case three (0.5 percent) than in case two (0.6 percent), but per capita income increases by slightly more in the former (0.6 percent) than in the latter (0.5 percent) case. The leftward shift of the labour supply function caused by the decline in the real value of the Heritage Fund, has made the achievement of extensive growth more difficult in the short run. In fact there has even been a small decline in the labour supply so that per capita income has risen.

6.4.2 The Long Run

In the long run it is assumed that the labour supply exhibits elastic responses to changes in the real value of the Heritage Fund (GAMLH = 50). The inclusion of the real value of the Heritage Fund in the labour supply function clearly has a greater effect in the long run than in the short run. Comparing the long run of case three with that of case two, it is clear that in the former much less industrial diversification has occurred. In particular, we see that whereas in case two there was a 34.9 percent expansion in the output of the secondary manufacturing sector, in case three this sector expands by only 15.4 percent. The service sector also expands by less in case three (6.5 percent compared with 9.8 percent). On the other hand primary renewable resources and primary manufacturing expand by slightly more, while primary non-renewable resources experiences a 0.4 percent increase in case three as opposed to a 1.7 percent

decline in case two.

Since the return to sector-specific land in sector one shows some increase, we would expect the nominal value of the Heritage Fund to increase as well. In Table 6.4 we observe that $\dot{H}$ does increase by 0.3 percent, but combined with a rise in the price index of 1.3 percent, the real value of the Heritage Fund is reduced by 1.0 percent. This drop in the real value of the Fund causes the labour supply curve to shift leftwards. We will again expect to find tighter labour supply conditions in the present case than in the comparable version of case two. Accordingly, the results show an increase in the labour supply of 5.5 percent compared with 8.1 percent for case two.

The reduced increase in the labour supply implies a smaller increase in demand for locally produced consumer goods and services. The smaller labour supply accounts in part for smaller expansion observed in the secondary manufacturing and service sector. A smaller increase in demand in the regional economy is reflected in generally smaller price increases. Hence the relative price of primary non-renewable resource output has declined by less. This accounts for sector one's ability to expand production in this case. Primary renewable resources and primary manufacturing experience greater expansion in case three because of the smaller increase in the nominal wage rate (1.6 percent compared to 3.1 percent in case two).

The smaller expansion of the secondary manufacturing sector in this simulation also arises because of the increased fiscal capacity of the government sector. Because revenues in the primary non-renewable resource sector have increased in the present case, the government is able to maintain the level of subsidization of labour in their consumption of government goods. The per capita levy ($\dot{TL}$) has risen by the same percentage as the average cost of

TABLE 6.4

CASE THREE: THE REAL VALUE OF THE HERITAGE FUND AS AN ARGUMENT IN THE LABOUR SUPPLY FUNCTION[1]

	Short Run[2]	Long Run[3]		Short Run	Long Run
Q_1	-0.4	0.4	RS4	-5.5	0.0
Q_2	-1.0	1.0	RS5	4.0	0.0
Q_3	-0.6	2.8	W	2.7	1.6
Q_4	-1.7	15.4	P	1.6	1.3
Q_5	0.7	6.5	Y	0.5	4.8
Q_6	-1.8	4.3	TL	2.0	1.5
P_2	0.9	1.1	H	-0.2	0.3
P_3	1.1	1.1	FR1	-0.5	0.7
P_4	0.3	1.1	FR2	-1.1	1.0
P_5	2.3	1.5	FR5	2.2	3.2
P_6	2.2	1.5	FK1	-0.9	0.0
R_1	-0.2	0.4	FK2	-2.3	0.0
R_2	-0.6	1.0	FK3	-1.7	0.0
R_5	1.1	6.5	FK4	-5.5	0.0
S_1	-0.1	0.6	FK5	4.0	0.0
S_2	-0.2	1.4	SAV	0.5	2.5
S_3	-0.2	2.9	YD	0.9	5.7
S_4	-0.6	15.6	Y^S	0.5	4.8
S_5	0.4	6.9	BOP	0.6	-1.4
L	-0.1	5.5	dBOP	-10.40	24.28
RR_1	-0.5	0.7	FSAV	-3.6	-10.50
RR_2	-1.1	1.0	dFSAV	52.63	153.51
RR_5	2.2	3.2	Y-L	0.6	-0.7
RS_1	-0.9	0.0	W-P	1.1	0.3
RS_2	2.3	0.0	H-P	-1.8	-1.0
RS_3	-1.7	0.0	$TL-P_6$	-0.2	0.0
			Y^S-L	0.6	-0.7

1 All values are given as percentage changes (i.e. $\dot{x} = (dx/x)\cdot 100$) except for dBOP and dFSAV which are in millions of dollars.

2 Labour supply elasticity with respect to the real value of the Heritage Fund = 1. Labour supply elasticity with respect to real wages = 0.1. Sector-specific capital supply elasticity (sectors 1,...,5) = 0.1. Resource supply elasticity (sectors 1,2,5) = 0.5.

3 Labour supply elasticity with respect to the real value of the Heritage Fund = 50. Labour supply elasticity with respect to real wages = 200. Sector-specific capital supply elasticity (sectors 1,...,5) = 400. Resource supply elasticity: sector 1 = 0.5, sector 2 = 1.0, sector 5 = 2.0.

providing government output ($\dot{P}_6$). Consequently, we would not expect to see the same amount of substitution of secondary manufacturing for government goods and services that occurred in case two when $\dot{TL}$ rose by 6.2 percent while P_6 rose by only 2.7 percent. In accordance with this, consumption of government output rises by 4.3 percent in the present case compared with the previous rise of 1.2 percent.

The redistribution of income resulting from this policy simulation is less pronounced than in case two. In the present case, all owners of fixed factors see their nominal returns increase somewhat, although relatively speaking, it is the owners of factors specific to the service sector who, as in case two, gain the most.

Aggregate real income increases by less in the present case than in case two (4.8 percent compared to 6.4 percent). Per capita income declines by less in this case than previously (-0.7 percent in case three, -1.7 percent in case two) because of the smaller increase in the labour force in this simulation.

Attempts to stimulate growth in secondary manufacturing and the service sector have clearly been less successful in this simulation where the labour supply has been more restricted. However, it is evident that the presence of a labour force that is less responsive to implicit subsidies offered by government has caused a reduction in the cost, in terms of foregone real per capita income, of this type of province-building strategy.

6.5 Case Four: Underpricing Feedstock to Primary Manufacturing

6.5.1 The Short Run

This case simulates the effects of supplying feedstock to the primary

manufacturing sector at less than its opportunity cost while continuing to impose an endogenous per capita levy. It is assumed that the primary manufacturing sector purchases inputs from the non-renewable sector at a price less than the exogenous price. The price of primary non-renewable resource output is assumed to rise by one percent, but primary manufacturing continues to purchase sector one's output at an unchanged price.

The short run results for this case are presented in Table 6.5. There appear to be only minor differences between this case and the case of the simple endogenous per capita levy (case two). In both cases, production in the primary non-renewable resource sector declines slightly (-0.4 percent in case two, -0.5 percent in case four). Sectors two, three and four all show declines in production that are somewhat less than in case two. The service sector expands by slightly less in the present case. The government sector however shows a greater decline in the present case of 0.4 percentage points. Similarly, there are no large differences in output price changes. The most notable are the smaller price increases in the government and primary manufacturing sectors in case four compared to case two.

These results are intuitively reasonable. The underpricing of feedstock to primary manufacturing means that the average price received by producers in the non-renewable sector has declined, and therefore, this sector contracts production by a larger amount. In turn, the derived demand for sector-specific factors (capital and land) declines by more in this case than in case two with comparable declines in their nominal rates of return. On the other hand, the now subsidized primary manufacturing sector experiences a smaller contraction than in case two. Consequently, the nominal return to sector-specific capital also shows a smaller decline in this sector. The price of output in primary

TABLE 6.5

CASE FOUR: UNDERPRICING FEEDSTOCK TO PRIMARY MANUFACTURING[1]

	Short[2] Run	Long[3] Run		Short Run	Long Run
Q_1	-0.5	-1.3	RS4	-3.8	0.0
Q_2	-0.8	0.7	RS5	3.7	0.0
Q_3	-0.4	1.7	W	2.1	1.9
Q_4	-1.2	20.2	P	1.4	1.8
Q_5	0.7	5.2	Y	0.3	3.3
Q_6	-2.0	-0.2	TL	2.2	4.1
P_2	0.7	1.2	H	-0.4	-0.8
P_3	0.7	0.9	FR1	-0.8	-1.7
P_4	0.4	1.2	FR2	-0.8	0.8
P_5	1.9	1.5	FR5	2.1	2.6
P_6	1.8	1.6	FK1	-1.7	0.0
R_1	-0.4	-0.9	FK2	-1.7	0.0
R_2	-0.4	0.8	FK3	-1.1	0.0
R_5	1.0	5.3	FK4	-3.8	0.0
S_1	-0.2	-1.4	FK5	3.7	0.0
S_2	-0.2	1.0	SAV	0.3	4.3
S_3	-0.1	1.9	YD	0.7	3.5
S_4	-0.4	20.5	Y^S	0.4	3.8
S_5	0.4	5.6	BOP	0.3	-20.8
L	0.1	4.3	dBOP	-5.2	360.67
RR_1	-0.8	-1.7	FSAV	-3.8	7.8
RR_2	-0.8	0.8	dFSAV	55.56	-114.04
RR_5	2.1	2.6	Y-L	0.2	-1.0
RS_1	-1.7	0.0	W-P	0.7	0.1
RS_2	-1.7	0.0	$TL-P_6$	0.4	2.5
RS_3	-1.1	0.0	Y^S-L	0.3	-0.5

1 All values are given as percentage changes (i.e. $\dot{x} = (dx/x)\cdot 100$) except for dBOP and dFSAV which are in millions of dollars.

2 Labour supply elasticity with respect to the real value of the Heritage Fund = 1. Labour supply elasticity with respect to real wages = 0.1. Sector-specific capital supply elasticity (sectors 1,...,5) = 0.1. Resource supply elasticity (sectors 1,2,5) = 0.5.

3 Labour supply elasticity with respect to the real value of the Heritage Fund = 50. Labour supply elasticity with respect to real wages = 200. Sector-specific capital supply elasticity (sectors 1,...,5) = 400. Resource supply elasticity: sector 1 = 0.5, sector 2 = 1.0, sector 5 = 2.0.

manufacturing does not increase by as much in the current case, reflecting the unchanged price of an important intermediate input which in case two had risen by 1.0 percent.

In case two it was observed that the per capita levy ($\dot{TL}$) rose by less than the average cost of providing government services ($\dot{P}_6$) implying that subsidization of labour's consumption of government services had increased. In the present case we observe instead that the per capita levy has actually risen by a greater amount than the average cost of government services. Clearly, the level of subsidization of labour has had to be reduced in the current case as a result of reduced tax revenues received from sector one.

Demand for labour has increased somewhat within the region owing to the expansion of the labour intensive service sector. Nominal wages rise by 2.1 percent and real wages by 0.7 percent - both changes being close in magnitude to those of case two. Changes in real income and real income per capita are slightly less in the present case compared to case two. Thus we observe a slightly reduced degree of both extensive and intensive growth in the short run when the policy of underpricing feedstock is incorporated.

6.5.2 The Long Run

In the long run results of case four shown in Table 6.5, a significant amount of industrial diversification is evident, but it is always slightly less than that which occurred in the long run results of case two. It is interesting to note that in the present case, where feedstock is underpriced to the primary manufacturing sector, that sector expands by 1.6 percentage points less than in case two where no underpricing of feedstock occurred. Secondary manufacturing increases by 20.2 percent - significantly less than the 34.9 percent rise in case

two. The service sector also expands, but again by less than in case two. The primary renewable sector increases by 0.7 percent in the current case, compared to the previous 1.4 percent increase. Primary non-renewable resource output actually declines by a smaller amount in the present case than in case two (-1.3 percent compared with -1.7 percent). Government output declines in the current case (-0.2 percent). Prices in each of sectors two through six show a smaller increase in case four than in case two.

These results can readily be explained by considering the effect on demand and production within the region of providing primary manufacturing with an advantage over other sectors. The lowering of input costs to sector three implies that firms in the sector can attract factors of production by offering higher returns and will thereby be able to expand output. However, primary manufacturing is not a highly labour intensive activity so that fewer people will be attracted to the region than for a comparable expansion of the service or secondary manufacturing sectors. The amount of labour in-migration that occurs is very important in determining the extent of 'spin-off' growth that will take place in other sectors as a result of increased final demand. The expansion of the labour supply by one 4.3 percent in the current case, compared to 8.1 percent in case two, will have a dampening effect on sectors which produce for final demand and on sectors supplying intermediate goods for final demand sectors. This means that production in the subsidized primary manufacturing sector will itself be adversely affected, as a large portion of its output goes into both final and intermediate demands. Hence reduced demand in the regional economy accounts for the smaller expansion in production that occurs in sectors two through six in the current case compared to case two.

The smaller decline in the primary non-renewable sector can be explained

by the smaller increase in nominal wages. The nominal wage is bid up by only 1.9 percent in case four compared to 3.1 percent in case two. Accordingly, sector one is better able to compete for labour supplies, and this advantage has overcome, to some extent, the disadvantage of having to sell a portion of its output at a reduced price.

The smaller contraction in the primary non-renewable sector in the present case implies that government tax revenues received from that sector will also decline by less. For this reason, the per capita levy has not had to rise by as much in case four (4.1 percent) as in case two (6.2 percent). The 1.6 percent rise in the cost of providing output ($\dot{P}_6$) in the present case indicates that the level of underpricing of public goods to labour has still experienced a decline.

It must be concluded from these results that the long run attempt to accelerate the growth of primary manufacturing through the underpricing of feedstock is self-defeating. This policy has been less successful at promoting industrial expansion in each of sectors three, four and five than was the simple endogenous per capita levy. The detrimental effects of the policy on the rest of the economy work to offset the stimulus to primary manufacturing achieved from underpricing feedstock. Aggregate real income has increased by only 3.3 percent in the present case compared to 6.4 percent in case two.

Real returns to labour and nominal returns to capital are observed to remain approximately constant as is expected in the long run case. Distributional consequences are very similar in cases two and four. In case four, however, owners of sector-specific land in the service sector do not experience as large an increase in nominal returns. Real per capita income declines by 1.0 percent in case four, compared to 1.7 percent in case two. This smaller decline is caused by the smaller increase in population in the region. Thus the efficiency

loss caused by government policies for industrial expansion is less in the present case than in case two when measured in terms of foregone per capita real income. This is the result of the fact that the combination of policies used in case four to promote diversification was less effective in achieving diversification than the more simple policy adopted in case two.

6.6 The Government Sector with an Endogenous Tax on Capital

6.6.1 The Short Run

In this case the government uses resource revenues to permit the reduction of taxes on capital. The per capita levy imposed on labour is now made precisely equal to the average per capita cost of supplying government services. It will be recalled that the supply of capital in the model depends on the after-tax return. In the other cases, because interest rates and taxes on capital were constant, changes in the prices of financial assets based on capital were equal to the changes in both the before- and after-tax returns to capital. In this case, however, since taxes on capital are now assumed to be changing, changes in before-tax returns to capital will diverge from changes in after-tax returns and prices of financial assets.

The short run results for case five are displayed in Table 6.6. It will be observed that the original exogenous shock of a one percent rise in the price of primary non-renewable output has resulted in a decline of 2.7 percent in the taxes on capital. This implies that government revenues have increased as a result of the exogenous price rise in the primary non-renewable sector so that a reduction in taxes on capital was necessitated in order to balance the budget. The fall in the rate of taxes on capital attenuates somewhat the decline in

production that occurs in sectors one through four in the short run version of each of cases one through five.

Comparing case five results with those of the staple boom, it is observed that sectors one through four all show smaller declines in production in the current case, while sector five shows a smaller production increase than in case one. Comparing case five results with those of case two (the endogenous per capita levy), it is evident that in both the primary resource sectors and in primary and secondary manufacturing the decline in output is somewhat less in case five than in case two. Similarly, the value of output in these sectors fares better in case five than case two - either declining by less or increasing by more in the former case over the latter. The service sector, on the other hand, shows a similar increase in the quantity and value of production in case five and case two.

These results follow from the revised specification of the budget constraint. The decline in output in all private sectors and the increase in service sector output is the result of sectoral competition for scarce supplies of labour. The service sector is always able to bid labour away from other sectors because of its status as a non-traded sector permits its output price to rise more than is possible in other sectors. However, because the service sector is relatively less capital-intensive compared to the other private sectors, the reduction in taxes on capital offsets some of the relative advantage possessed by the service sector. Reducing taxes on capital reduces costs for firms, especially for those that use capital most intensively. This makes these sectors better able to compete for labour, and accordingly, we see that the shift in production to the labour-intensive service sector is somewhat less in case five.

TABLE 6.6

CASE FIVE: THE GOVERNMENT SECTOR WITH AN ENDOGENOUS TAX ON CAPITAL[1]

	Short[2] Run	Long[3] Run		Short Run	Long Run
Q_1	-0.3	0.3	RK4	-5.0	0.5
Q_2	-0.9	1.2	RK5	4.1	0.5
Q_3	-0.4	2.9	W	2.5	1.3
Q_4	-1.4	15.9	P	1.6	1.3
Q_5	0.8	6.8	Y	0.7	4.9
Q_6	-1.7	4.6	TL	2.1	1.3
P_2	0.8	1.1	H	-0.2	0.3
P_3	1.0	1.1	FR1	-0.3	0.6
P_4	0.4	1.1	FR2	-1.0	1.1
P_5	2.3	1.4	FR5	2.4	3.3
P_6	2.1	1.3	FK1	-0.2	0.0
R_1	-0.2	0.3	FK2	-1.6	0.0
R_2	-0.5	1.1	FK3	-0.8	0.0
R_5	1.2	6.7	FK4	-4.3	0.0
K_1	0.0	0.3	FK5	4.8	0.0
K_2	-0.2	1.3	SAV	0.7	2.5
K_3	-0.1	3.0	YD	1.1	5.8
K_4	-0.4	16.0	BOP	0.9	-1.4
K_5	0.5	7.0	dBOP	-15.61	24.28
L	0.1	5.8	FSAV	-4.7	-10.9
RR_1	-0.3	0.6	dFSAV	68.71	159.36
RR_2	-1.0	1.1	TAXK	-2.7	2.0
RR_5	2.4	3.3	Y-L	0.6	-0.9
RK_1	-0.8	0.5	W-P	0.9	0.0
RK_2	-2.2	0.5	TL-P6	0.0	0.0
RK_3	-1.5	0.5			

1 All values are given as percentage changes (i.e. x = (dx/x)·100) except for $_{\text{dBOP}}$ and $_{\text{dFSAV}}$ which are in millions of dollars.

2 Labour supply elasticity = 0.1. Sector-specific capital supply elasticity (sectors 1,...,5) = 0.1. Resource supply elasticity (sectors 1,2,5) = 0.5.

3 Labour supply elasticity = 200. Sector-specific capital supply elasticity (sectors 1,...,5) = 400. Resource supply elasticity: sector 1 = 0.5, sector 2 = 1.0, sector 5 = 2.0.

The rest of the results for case five follow logically from the effect of the decline in taxes on capital. Comparing case two and case five, we observe that the prices of financial assets based on sector-specific capital (which are equal to after-tax returns) always rise more in case five. Similarly, the supply of sector-specific capital in each sector increases by more or falls by less in case five than in case two.

Changes in nominal returns to resource land are predictable. The owners of land in the service sector find the nominal return to their factor increase while owners in sectors one and two will see their nominal return diminish. The decreased returns to the immobile factor in sectors one and two are marginally less in case five than in case two. These changes in return are, of course, equal to the changes in the prices of financial assets based on resource land since there is no change in resource taxes or in the interest rate.

The supply of labour in case five shows a slight increase of 0.1 percent, similar to that shown in case two. This is the result of equivalent changes in real wages in the two cases (0.9 percent in both). The endogenous per capita levy is constrained to rise by the same amount as the increase in the average cost of providing government services (2.1 percent). This rise is slightly more than the rise in $\dot{TL}$ in case two, and accounts for the slightly larger reduction in government output which occurs in the current case.

The endogenous tax on capital, by moderating the contraction of sectors one through four, has caused a greater increase in aggregate income (Y) in the short run than has the simple endogenous per capita levy (0.7 percent for case five, 0.6 percent for case two). Similarly, per capita income rises by 0.1 percentage points more in case five than in case two.

The increased investment caused by the rise in after-tax returns is

accomodated by increased saving. Domestic saving rises by 0.7 percent. The indicated percentage change in foreign saving ($F\dot{S}AV$) of -4.7 percent implies that the initial outflow of long-term capital has been reduced by 68.7 million dollars. The balance of payments shows a percentage change of 0.9 percent. This implies that the original short-term outflow has been increased, which, in turn, implies that the increase in the value of exports has exceeded any positive change in the value of imports. This result can be attributed to the positive change in the value of production of traditional export sectors (one and three).

6.6.2 The Long Run

The long run results of case five, presented in Table 6.6, indicate that the requirement to balance the budget leads the government to raise the taxes on capital by 2.0 percent. This tax increase has occurred even though the returns to sector-specific capital and land resources have increased, and the per capita levy has been constrained to rise at the same rate as does the average cost of providing government services. The reason for this result is that in our rate-of-change formulation of the model, the share of taxes from labour in total government revenues and the share of government expenditures on goods and services in total government use of funds are assumed to remain constant. The share of government revenues provided by taxes on labour is 15.2 percent (g_L in equation 5.17'). The share of government expenditures that goes to producing goods and services is 46 percent (g_e in equation 5.17'). Thus, the aggregate share of tax revenues contributed by labour ($gL(\dot{T}\dot{L} + \dot{L})$ in equation 5.17') does not cover the change in government expenditures on goods and services ($ge(\dot{P}_6 + \dot{Q}_6)$) in equation 5.17'). This accounts for the necessary rise in taxes on capital.

A review of the sectoral price and output changes for case five indicates

that some long run diversification of the regional economy has occurred, but not as much as in the case of the endogenous per capita levy (case two). Most notably, output in secondary manufacturing increases by only 15.9 percent in case five, compared to 34.9 percent in case two. The service sector also expands by less in case five. On the other hand, the primary non-renewable sector manages to expand its output by 0.3 percent unlike the 1.7 percent contraction experienced in case two.

The extent of industrial diversification which occurs in this case can be explained along similar lines to that provided in the discussion of the case of the endogenous per capita levy. The present case generates fiscally induced migration of capital to the region, just as the endogenous per capita levy caused fiscally induced labour migration. The migration of capital to the region in response to an initial lowering of taxes relative to other jurisdictions stimulates production within the economy and increases the demand for labour. The labour induced to the region by the rise in the capital/labour ratio leads to an increase in demand for local goods and services which in turn further stimulates local production. The increased demand for government goods and services which results from the growing labour supply will eventually force the government to raise taxes on capital in order to pay for the production of these goods and services. This increase in taxes will attenuate somewhat the migration of capital to the province. The migration of capital will stop once after-tax returns have been equalized across regions.

The somewhat smaller amount of industrial diversification which occurs in case five compared to case two can be explained largely by the absence of a strong substitution effect between the government sector and secondary manufacturing. In case two, consumption of government services was curtailed and

that of secondary manufacturing encouraged by a sharp increase (6.2 percent) in the per capita levy. This effect is not evident in the present case where the per capita levy is restricted to rise with the average cost of government services. Consumption of government services rises by 4.6 percent compared with 1.2 percent in case two.

The other noteworthy difference between case four and case two is the significantly stronger performance (in terms of output) of the primary non-renewable resource sector. This can be attributed to the fact that the price increases indicated in sectors two through six are generally less than those for the same sectors in case two. Thus, the price of sector one's output relative to the other sectors in the current case declines less than in case two.

The general price index ($\dot{P}$) rises by 2.7 percentage points less in the present case than in case two. This result is indicative of the generally smaller growth in demand in case five. As discussed in section 6.6.1, the endogenous tax on capital originally provides stimulation disproportionately to those sectors which are most capital-intensive. Consequently, the labour-intensive service and secondary manufacturing sectors are influenced relatively less than in the case of the endogenous per capita levy, implying a reduced increase in the demand for labour. Our results show a 5.8 percent increase in the labour supply, compared to 8.1 percent in case two. Likewise, nominal wages have not been bid up by as much in the current case (1.3 percent instead of 3.1 percent). With a smaller increase in the labour supply, demand in the local economy will show less growth than was the case in case two.

The results for the remaining variables, such as the supply of and returns to sector-specific capital and land, all follow logically from the changes in sectoral price and quantity just discussed. The increased investment in capital and land

required to expand production is accomodated by a 2.5 percent increase in domestic savings and by a reduction of the initial outflow of long-term capital. The negative percentage change in short-term capital flow indicates that the original short-term capital outflow has been reduced by 26.0 million dollars. The value of imports must have increased by more than the value of exports. This is due to increased demand for secondary manufactured products which induces more imports as well as stimulating local production.

In summary, the endogenous tax on capital has been somewhat less successful than the endogenous per capita levy at promoting industrial growth in sectors four and five. The relative decline in the position of the primary resource sectors in terms of value of output has therefore been less pronounced than in case two. As a consequence, we observe that redistribution of income among owners of immobile factors has also been less marked. Owners of land in sectors one, two and three all find that their nominal returns increase, although the largest increase in return occurs as before in the service sector. Aggregate real income ($\dot{Y}$) increases by less in case five than in case two (4.9 percent compared to 6.4 percent). Real income per capita ($\dot{Y}-\dot{L}$), on the other hand, shows a smaller decline in case five. In short, the reduced success of the current policy option in achieving growth in secondary manufacturing and services implies reduced in-migration of labour and smaller costs in terms of foregone per capita income than does the endogenous per capita levy.

6.7 Synthesis

A synthesis of the major results of this chapter is provided in Tables 6.7 and 6.8. The long and short run simulations of each of cases two through five are compared to those of the classic staple boom. The staple boom is used as a

reference case, demonstrating the consequences for a small, open regional economy of an improvement in its terms of trade when all rents are privatized. The other cases simulate the effect of some type of government scheme to redistribute rents.

The short run results are presented in Table 6.7. The upper half of the table shows, for each case, the growth in per capita real income, the growth in the value of production of sectors three through six, and a simple average of the percentage changes in the value of primary and secondary industry and of the service sector. The lower half of the table shows the difference between the values of these variables in cases two through five and those for the staple boom case.

The deviations from the staple boom in the short run suggest the point made earlier that government rent redistribution schemes tend to moderate the short run outcome of the classic staple boom. This outcome involves a strong shift in value of production to the service sector in anticipation of future increases in demand for that sector's output. In the short run staple boom, the service sector is able to bid scarce factor supplies away from other sectors, and thereby expand production at their expense. In the other cases, the presence of a government sector which imposes taxes and redistributes rent moderates the shift to the service sector. Hence, we observe from Table 6.7 that although some shift toward services occurs in every case, the staple boom shows the largest growth in the service sector. Furthermore, the decline in primary non-renewable resources that occurs in the staple boom is not evident in the other cases. Deviations from the staple boom in primary resource sector growth are all positive in value. Finally, comparing the short run changes in real per capita

income, it is observed that the staple boom exhibits a larger amount of growth in this variable than in any of the other cases.

TABLE 6.7

SUMMARY OF RESULTS: THE SHORT RUN

		Case 1	Case 2	Case 3	Case 4	Case 5
Primary non-renewable resources	(P_1+Q_1)	-0.2	0.6	0.6	0.5	0.7
Industrial and service sectors	(P_3+Q_3)	1.1	0.6	0.5	0.3	0.6
	(P_4+Q_4)	-3.4	-1.3	-1.4	-0.8	-1.0
	(P_5+Q_5)	5.3	1.5	3.0	2.6	3.1
Government sector	(P_6+Q_6)	--	0.6	0.4	-0.2	0.4
Average percent change in the industrial and service sectors		1.0	0.3	0.7	1.8	0.9
Real per capita income	(Y-L)	1.6	0.5	0.6	0.2	0.6

DEVIATION FROM THE STAPLE BOOM (CASE ONE)
(COLUMN 1 IS SUBSTRACTED FROM EACH OF COLUMNS 2,3,4 & 5 ABOVE)
(PERCENTAGE POINTS)

	Case 1	Case 2	Case 3	Case 4	Case 5
Primary non-renewable resources	x	0.8	0.8	0.7	0.9
Industrial and service sectors	x	-0.7	-0.3	0.8	-0.1
Real per capita income	x	-1.1	-1.0	-1.4	-1.0

Table 6.8 presents the long run results. The deviations of cases two through five from the staple boom provide a means of rating different policy options in terms of their ability to promote long run economic diversification. Diversification is measured here in terms of average growth of sectors three,

four and five relative to the classic staple boom. It is also useful to review long run changes in the value of production in the primary non-renewable sector in order to observe the extent to which this sector's position in the economy has improved or deteriorated relative to the other sectors.

TABLE 6.8

SUMMARY OF RESULTS: THE LONG RUN
(PERCENT)

		Case 1	Case 2	Case 3	Case 4	Case 5
Primary non-renewable resources	(P_1+Q_1)	3.8	-0.7	1.4	-0.3	1.3
Industrial and service sectors	(P_3+Q_3)	0.8	5.1	3.9	2.6	4.0
	(P_4+Q_4)	-0.7	36.9	16.5	21.4	17.0
	(P_5+Q_5)	0.6	12.4	8.0	6.7	8.2
Government sector	(P_6+Q_6)	--	4.4	2.8	1.4	5.5
Average percent change in the industrial and service sectors		0.7	18.1	9.5	10.2	9.7
Real per capita income	(Y-L)	0.6	-1.7	-0.7	-1.0	-0.9

DEVIATION FROM THE STAPLE BOOM (CASE ONE)
(COLUMN 1 IS SUBSTRACTED FROM EACH OF COLUMNS 2,3,4 & 5 ABOVE)
(PERCENTAGE POINTS)

	Case 1	Case 2	Case 3	Case 4	Case 5
Primary non-renewable resources	x	-4.5	-2.4	-4.1	-2.5
Industrial and service sectors	x	17.4	8.8	9.5	9.0
Real per capita income	x	-2.3	-1.3	-1.6	-1.5

Clearly, the most successful policy option in achieving diversification in the long run is the simple endogenous per capita levy (case two). Case two exhibits the largest average increase in the industrial and service sectors relative to the staple boom and also shows the largest relative decline in the value of the primary non-renewable resource sector. However, including the assumption that the labour supply responds to the real value of the Heritage Fund (case three) weakens substantially the effectiveness of the endogenous per capita levy. Case three shows the smallest amount of growth in industry and services compared to the staple boom. Case four (underpricing feedstock to sector three) and case five (endogenous tax on capital) achieve intermediate results. Both cases exhibit some growth in the industrial and service sectors, with the former showing the slightly larger deviation from the staple boom (9.5 percentage points in case four compared to 9.0 in case five). Case four also shows a larger relative decline in the value of output of primary non-renewable resources. In summary, the rating of government policy initiatives in terms of their ability to promote diversification relative to the staple boom from best to worst is as follows: (1) the simple endogenous per capital levy (case two), (2) the endogenous per capita levy and the underpricing of feedstock to sector three (case four), (3) the endogenous tax on capital (case five), and (4) the endogenous per capita levy and the real value of the Heritage Fund as an argument in the labour supply function (case three).

Real per capita income increases in the classic staple boom in the long run, while declining in all other long run cases. This foregone real per capita income in cases two through five represents a cost of government policies promoting diversification. The different rent distribution schemes can be rated according to their cost in terms of foregone income relative to the staple boom.

Deviations from the staple boom show that the simple endogenous per capita levy (case two) involves the greatest cost, followed by case four, case five and finally case three. It will be observed that this rating is the same as that for success at diversification. In short, these simulations indicate that the less successful is a government scheme to promote diversification, the smaller will be the cost of the scheme in terms of foregone real per capita income.

As a final note, it should be pointed out when comparing simulations involving government to those of the classic staple boom that all of the former simulations neglect the "wealth effect" of the Heritage Fund. The stock of savings in the Heritage Fund is an asset owned by the community-at-large. Our simulations ignore the return from this asset and therefore may be overstating the long run decline in per capita income observed in cases two through five. In order to test the importance of this effect, the long and short run simulations of case two (the simple endogenous per capita levy) were rerun with the share of government revenues going to the Heritage Fund set to zero. In the short run it was found that there was no difference in the simulations with and without the Heritage Fund. In the long run, as expected, when the Heritage Fund was excluded from the model real per capita income showed a decline, but somewhat less than in the original simulation (-0.9 compared to -1.7 in case two). Thus the simulation with no Heritage Fund still shows a cost in terms of foregone per capita real income of government rent redistribution. However, this cost is relatively less compared to the staple boom than when the Heritage Fund is included. This result of ignoring the wealth effect of the Fund should be kept in mind when comparing the simulation results with and without the government sector.

Chapter 7

SUMMARY AND CONCLUSIONS

7.1 Summary of Major Observations

Several observations have been made and conclusions drawn in this thesis regarding the response of a small open economy to an improvement in its terms of trade and the effects of government imposed rent redistribution schemes. The major observations are summarized below.

1. Traditional trade theory predicts that, in response to an improvement in its terms of trade, a region will become more specialized in the production of these commodities in which it has a comparative advantage. Thus, following the rise in the relative price of energy (ignoring any government intervention), an energy-rich province such as Alberta should become increasingly specialized in energy production. Some growth in manufacturing and service sectors would be expected in response to the increased size of local markets. However such industrial and service sector growth is not true economic diversification in the sense of making the economy less dependent on primary energy resources. These newly developed sectors depend for their existence on demand conditions in local markets created by the booming resource sector. If the industrial base is to expand and become an independent export sector, the region must possess some heretofore unrecognized comparative advantage in industrial production. Alternatively, a comparative advantage must somehow develop over time as extensive growth occurs within the region as a result of some type of agglomeration economies.

2. The governments of energy-rich provinces are able, through their powers of taxation, to capture a significant portion of the greatly enhanced resource rents and use this revenue to pursue specific provincial goals. The manner in which Alberta and other energy-rich provinces choose to deal with energy rents has important implications for the structure of, and the efficient allocation of resources within, the provincial and Canadian economies. This thesis has reviewed in theoretical terms various possible rent distribution schemes. It was observed that any scheme which distributes rent over a prolonged period of time and which makes residency in Alberta a condition for receiving the benefits of the rent will give rise to fiscally-induced migration of factors of production and will result in an inefficient allocation of resources across Canada. This inefficient resource allocation imposes a cost both on Albertans and on other Canadians. It can be measured in terms of the differences in the marginal product of productive factors under the scheme which produces fiscally-induced migration compared to a scheme which is neutral with respect to migration. If the factor supply to Alberta is perfectly elastic, the marginal product of the mobile factor will be lower in Alberta than in other jurisdictions by the extent of the fiscal advantage offered in Alberta.

3. Some individuals will be better off as a result of government rent redistribution schemes which encourage extensive growth within the province. Owners of immobile productive factors (e.g. houses and land in urban areas) will experience substantial increase in the prices of their assets.

4. A more detailed analysis of the effects of various energy rent distribution schemes on the provincial economy was provided using a simple multi-sector general equilibrium model of a small, open, regional economy. The simulation results confirmed the conclusions of the theoretical discussion. When the government sector was excluded from the model (the classic staple boom), the imposed one percent rise in the relative price of energy caused the primary energy resource sector to expand relative to the other sectors of the economy and resulted in an increase in real after-tax income. In the other simulations, the government sector was assumed to impose some rent redistribution scheme intended to promote economic diversification through, for example, the subsidization of mobile factors of production. In each of the government imposed schemes, significant growth in manufacturing and services was achieved, but only at the expense of growth in real per capita income.

7.2 Conclusions

To restate the major conclusion of this thesis, the province-building objectives and policies of the Alberta government impose costs on Albertans and on Canadians generally, in terms of foregone real per capita income. Although the income distributional consequences of these policies imply that some individuals will be better off, overall real per capita income will be reduced compared to the case when the government does not use fiscal incentives to promote economic diversification.

The provincial government may through fiscal incentives succeed in enticing more industry to locate in the province but the result will be a larger,

not stronger, economy. Except under the very special circumstances of the presence of significant agglomeration economies, the industry that is attracted because of fiscal incentives will expire when those incentives are removed. This will occur upon depletion of Alberta's non-renewable resource base. Consequently, the objective of the provincial government to reduce dependence on the primary resource sector will not be achieved and the attempts to attain this goal through province-building policies will have been costly.

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Appendix I

CALCULATION OF PARAMETER VALUES USED IN THE MODEL

Equation (5.2') (unit cost equals price)

The parameter θ_{ix} represents the share in the value of a unit of output of sector i attributed to the input with factor price x (that is, using the notation of chapter 5, $\theta_{ix} = (\partial C^i(\cdot)/\partial x)/P_i$). The values that were calculated for θ_{ix} and used in the model are listed as follows:

Sector one		Sector two		Sector three		Sector four		Sector five		Sector six	
θ_{11}	0.005	θ_{21}	0.001	θ_{31}	0.164	θ_{41}	0.004	θ_{51}	0.003	θ_{61}	--
θ_{12}	--	θ_{22}	0.063	θ_{32}	0.145	θ_{42}	0.002	θ_{52}	0.005	θ_{62}	--
θ_{13}	0.030	θ_{23}	0.154	θ_{33}	0.215	θ_{43}	0.110	θ_{53}	0.068	θ_{63}	0.081
θ_{14}	0.010	θ_{24}	0.026	θ_{34}	0.021	θ_{44}	0.298	θ_{54}	0.084	θ_{64}	0.063
θ_{15}	0.363	θ_{25}	0.170	θ_{35}	0.133	θ_{45}	0.141	θ_{55}	0.325	θ_{65}	0.426
θ_{1L}	0.152	θ_{2L}	0.284	θ_{3L}	0.176	θ_{4L}	0.270	θ_{5L}	0.320	θ_{6L}	0.418
θ_{1R}	0.219	θ_{2R}	0.151	θ_{3R}	--	θ_{4R}	--	θ_{5R}	0.097	θ_{6R}	--
θ_{1K}	0.219	θ_{2K}	0.151	θ_{3K}	0.146	θ_{4K}	0.175	θ_{5K}	0.097	θ_{6R}	--

These values were calculated from Canada (1979, Table 123). Using the input-output matrix for Canada for 1974, each of the 100 commodity groups and the 43 industry groups was classified according to which of the six sectors defined in the model it fit into best. The input data was then amalgamated into the six industrial sector groups so that the value of a unit of output in one sector attributable to the input from another sector or to labour, capital or land could be calculated. For those sectors which are assumed to use both a land and a capital input, the residual corporate share (net income, unincorporated business, other operating surplus) was divided equally between capital and land. In the remaining sectors which have some capital input, but no land input, the whole of

the residual corporate share was attributed to capital. In the government sector, neither capital nor land are assumed to be used as inputs so that the residual corporate share was netted out.

The use of the Canadian input-output tables to calculate the θ_{ix}'s requires the assumption that input-output coefficients for the Alberta economy are similar to those for Canada as a whole.

<u>Equations (5.3'), (5.4') and (5.5')</u> (full employment)

The θ_{ix} used in equation (5.2') are the same as those used in the full employment equations.

σ^i_{xy} is the technical elasticity of substitution between factors with prices x and y in sector i. The values for these parameters were assigned arbitrarily according to what were considered to be reasonable guesses. It was assumed that there exists no possibility for substitution between purchased intermediate inputs and the primary factors (land, labour and capital) - that is, $\sigma_{P_{ij},k} = \sigma_{P_{ij},w} = \sigma_{P_{ij},r} = 0$. The elasticities of substitution among the primary factors are all assumed to be 0.5 - that is, $\sigma_{r,k} = \sigma_{w,r} = \sigma_{w,k} = 0.5$.

λ_i represents the proportion of the total labour force employed in sector i. The parameter values used in the model are as follows:

Sector	λ_i
1	0.04
2	0.14
3	0.05
4	0.04
5	0.66
6	0.07

These values were calculated from 1976 data of the distribution of the labour force in Alberta provided in Alberta (1978a, Table 32).

Equation (5.6') (demand)

S_{iF}, S_{iE} and S_{ij} represent the proportion of total production of the ith sector which goes into final demand (F), net exports (E), or intermediate demand in sector j. The values assigned to these parameters are as follows:

Sector one		Sector two		Sector three		Sector four		Sector five		Sector six	
S_{11}	0.002	S_{21}	0.001	S_{31}	0.140	S_{41}	0.010	S_{51}	0.004	S_{61}	--
S_{12}	--	S_{22}	0.071	S_{32}	0.124	S_{42}	0.006	S_{52}	0.007	S_{62}	--
S_{13}	0.015	S_{23}	0.174	S_{33}	0.184	S_{43}	0.295	S_{53}	0.101	S_{63}	--
S_{14}	0.005	S_{24}	0.029	S_{34}	0.018	S_{44}	0.799	S_{54}	0.125	S_{64}	--
S_{15}	0.181	S_{25}	0.192	S_{35}	0.113	S_{45}	0.379	S_{55}	0.485	S_{65}	0.19
S_{16}	--	S_{26}	--	S_{36}	--	S_{46}	--	S_{56}	--	S_{66}	0.01
S_{1F}	--	S_{2F}	--	S_{3F}	0.296	S_{4F}	2.644	S_{5F}	0.276	S_{6F}	0.80
S_{1E}	0.797	S_{2E}	0.532	S_{3E}	0.126	S_{4E}	-3.133	S_{5E}	--	S_{6E}	--

These parameters were calculated using data of the input-output structure of the Alberta economy in 1974, supplied by the Alberta Bureau of Statistics.

η_i represents the income elasticity of demand for the output of sector i. Values were assigned to this parameter as follows:

$\eta_3 = 0.8$

$\eta_4 = 0.8$

$\eta_5 = 1.1$

$\eta_6 = 1.2$

ε_{ij} represents own and cross uncompensated price elasticities. It relates the proportionate change in demand for good j to the proportionate change in the price of good i. The following values were assigned to this parameter:

Sector three	Sector four	Sector five	Sector six
ε_{33} -0.5	ε_{44} -1.2	ε_{55} -0.4	ε_{6} -1.1
ε_{34} -0.334	ε_{43} -0.307	ε_{53} 0	ε_{63} 0
ε_{35} 0	ε_{45} 0	ε_{54} -0.52	ε_{64} 1.25
ε_{36} 0	ε_{46} 0.5	ε_{56} -0.6	ε_{65} -0.7

According to standard microeconomic theory, the following three relationships must hold among income and uncompensated price elasticities (Henderson and Quandt, 1971).

$$\sum_{j=3}^{6} \alpha_j \varepsilon_{ij} = - \alpha_i \qquad i=3,\ldots,6 \tag{A.1}$$

where α_j is the proportion of total expenditures accounted for by spending on the output of sector j

$$\sum_{i=3}^{6} \varepsilon_{ij} = - \eta_j \qquad j=3,\ldots,6 \tag{A.2}$$

$$\sum_{j=3}^{6} \alpha_j \eta_j = 1 \qquad j=3,\ldots,6 \tag{A.3}$$

There are nine equations and twenty elasticites to be specified. Thus, eleven of the elasticities must be assigned arbitrarily and the remaining nine can be determined by solving the above equations. The nine elasticities for which values were assigned arbitrarily are η_4, η_5, η_6, ε_{53}, ε_{63}, ε_{35}, ε_{36}, ε_{33}, ε_{44}, ε_{55}, and ε_{66}. The following values were used for α_i

Sector	α_i
3	0.161
4	0.241
5	0.403
6	0.195

The method of calculating these αi is described in reference to equation (5.15').

τi is the elasticity of export demand with respect to relative price of the output of sectors two and three. In the case of sector four, τi is the elasticity of import supply facing Alberta. The values for these elasticities were set arbitrarily according to what were thought to be reasonable guesses. It was assumed that τi would be quite high and negative for sectors two and three as these products are quite homogeneous in nature and have close substitutes from competing supply areas. For sector four it was thought that τi would be a fairly high positive value since the Alberta market for secondary manufacturing is small relative to potential supply from central Canada or the rest of the world. The values assumed for τi in the model are as follows:

Sector	τi
2	-2
3	-3
4	4

Equations (5.10') and (5.11') (factor supply equations)

γ_{ri} and γ_{ki} are the elasticities of the supply of sector-specific resource land and capital with respect to their after-tax rental rates. The values for these parameters were assigned arbitrarily and differ in the short run and long run cases.

Sector	γri		γki	
	short run	long run	short run	long run
1	0.5	0.5	0.1	400
2	0.5	1	0.1	400
3	---	--	0.1	400
4	---	--	0.1	400
5	0.5	2	0.1	400

In the short run, it is assumed that factors have not had sufficient time to respond fully to changes in after-tax returns. Thus all short run γ_i are less than unity. In the long run capital is assumed to be highly responsive to changes in after-tax return. Land in sectors two and five is somewhat more responsive in the long run as there has presumably been sufficient time for land development to have occurred. Land in sector one consists of a non-renewable resource. It is therefore assumed to exhibit inelastic supply responses in both the short and long runs. This is as would be expected in a fairly mature producing region of non-renewable energy resources.

Tr_i and Tk_i are the ad valorem tax rates on resource land and on capital, respectively. The values assigned arbitrarily to these tax rates are as follows:

Sector	Tr_i	Tk_i
1	0.55	0.2
2	0.20	0.2
3	--	0.2
4	--	0.2
5	0.20	0.2

Equation (5.14') (labour supply)

γ_L is the elasticity of labour supply with respect to relative real wages between regions. Values were arbitrarily assigned to this parameter which differ in the short and long run cases:

	Short run	Long run
γ_L	0.1	200

γ_{LH} is the elasticity of labour supply with respect to the real value of the Heritage Fund. It is employed only in case three. γ_{LH} is arbitrarily assigned the

following values:

	Short run	Long run
γ_{LH}	0.1	50

Equation (5.15') (the consumer price index)

γ_i is the share of the ^{i}th sector in the representative consumer's budget.

$$\alpha_i = \frac{P_i Q_i^R}{P}$$

where,

$$P = \sum_{i=1}^{6} P_i Q_i^R$$

and $P_i Q_i^R$ is the expenditure on the ith sector's output by a representative individual.

The values assigned to α_i are as follows:

Sector	α_i
3	0.161
4	0.241
5	0.403
6	0.195

α_6 was calculated from Alberta (1978b, Table 10). For the year 1976, the quantity

1 - (personal disposable income/total personal income)

which equals $(1 - 10445/12974) = .195$

was taken to be the portion of a representative individual's budget spent on government goods and services ($\alpha_6 = 0.195$). The remaining 0.805 of an individual's budget was prorated according to the arbitrary assumption that

expenditures out of the remaining disposable income are allocated such that twenty percent is spent in sector three, thirty percent in sector four, and fifty percent in sector five.

Equation (5.16') (after-tax income)

YL, YR_i, and YK_i are the shares of labour, sector-specific land and sector-specific capital in before-tax income, respectively. The values assigned to these parameters are as follows:

$YL = 0.567$

Sector	YR_i	YK_i
1	0.066	0.066
2	0.015	0.015
3	--	0.018
4	--	0.015
5	0.119	0.119

These parameters were calculated using the previously calculated θ_{ix} which represent the share of the value of a unit of output of sector i attributed to the input with factor price x. The intermediate input shares (θ_{ij}) were netted out from each sector so that the distributive share of labour, capital and land in value added in each sector could be calculated. The distributive shares in value-added by factor are as follows:

Sector	θ_{iL}	θ_{iR}	θ_{iK}
1	0.258	0.371	0.371
2	0.485	0.257	0.257
3	0.547	--	0.453
4	0.607	--	0.393

Sector	θ_{iL}	θ_{iR}	θ_{iK}
5	0.622	0.189	0.189
6	1.000	--	--

Next, using data of Alberta's gross domestic product by industry in 1976 supplied in the Alberta Statistical Review, Annual, 1978, Table 46, the distribution of value added by sector was calculated:

Sector	Share in value added
1	0.177
2	0.054
3	0.040
4	0.380
5	0.629
6	0.057

These two sets of information were then used to calculate YL, YR_i and YK_i in the following manner:

$$YL = \sum_{i=1}^{5} \theta_{iL} \text{ (share in value added of sector i)}$$

$$YR_i = (\theta_{iR}) \text{ (share in value added of sector i)} \qquad i=1,\ldots,5$$

$$YK_i = (\theta_{iK}) \text{ (share in value added of sector i)}$$

For example, $YR_i = 0.371\ (0.177) = 0.066$.

YTK_i and YTR_i are the shares of taxes in the income of the ith factor. These parameters are assigned values as follows:

Sector	YTR_i	YTK_i
1	0.036	0.013
2	0.003	0.003
3	--	0.004

Sector	YTR_i	YTK_i
4	--	0.003
5	0.024	0.024

These values are derived by multiplying the shares of land and capital in before-tax income (YR_i and YK_i) by the assumed tax rates (Tr_i and Tk_i).

Equation (5.17') (government budget constraint)

G_{xi} is the share contributed by factor x of the ith sector to government revenues. The following values were assigned to this parameter:

GL = 0.15

Sector	GR_i	GK_i
1	0.710	0.019
2	0.008	0.004
3	--	0.005
4	--	0.004
5	0.066	0.034

Data used to calculate these parameters was taken from the Alberta (1978b, Tables 17 and 19). Total provincial government revenue received from labour in 1976 was determined as follows:

	(millions of $)
Direct provincial taxes on persons	515
Other current transfers from persons	113
Indirect provincial taxes (falling mainly on persons)	
Amusement	5
Gasoline	90
Licenses	37

	(millions of $)
Tobacco	18
Liquor	109
Miscellaneous	42
Total	929

Provincial government revenues in 1976 from land in sector one was estimated as follows:

	(millions of $)
Investment income (provincial plus local government)	2226
Indirect taxes:	
Miscellaneous taxes on natural resources	181
Heritage Fund (estimated)	1993
Total	4400

Revenue going to the Heritage Fund was determined by subtracting a value for 1976 provincial and local government saving net of the Heritage Fund ($1364 million) from a value which included the Heritage Fund ($3357 million). The former is provided in Table 17 and the latter in Table 5 of the Alberta, (1978b). Provincial government revenue in 1976 from land in sectors two and five was estimated to be as follows:

	(millions of $)
Indirect taxes	
Provincial-real property tax	4
Local-real and personal property tax	455
Total	459

Taxes on capital in 1976 were estimated to be as follows:

	(millions of \$)
Direct taxes (provincial) - business enterprises	341
Indirect taxes (local)	
Business taxes	48
Miscellaneous	19
Total	408
GRAND TOTAL	6210

To prorate the total of \$459 million of government revenue from land in sectors two and five, the previously determined distribution of gross income by sector (YR_i in equation (5.16')) was employed. Similarly, sectoral gross income distribution among capital from different sectors (YK_i in equation (5.16')) was used to prorate total taxes on capital across all sectors. Once the data are prorated across all sectors the GL, GR_i and GK_i are calculated by determining the share of each factor in government revenue. For example, labour's share (GL) is equal to \$929 million divided by \$6210 million or 0.15.

G_e and G_H in equation (5.17') are the shares of provincial government revenue allocated respectively to producing goods and services and to savings. Savings is defined to include both revenues allocated to the HSTF and general government saving. G_e and G_H are calculated from the Alberta (1978b, Tables 5 and 17). From these tables, in 1976,

Total government saving	= \$3357 million
Government saving net of the HSTF	= \$1364 million
HSTF (= 3357 - 1364)	= \$1993 million
Total government outlays	= \$4804 million

(on goods and services, transfer payments to persons, subsidies, capital assistance, interest on debt,

transfers to other levels of government and general saving not including the HSTF)

Total outlays plus the HSTF	= \$6797 million
Subtract transfers from federal government	- \$ 587 million
Total	= \$6210 million

$$G_H = \frac{\text{Government Saving}}{\text{Government Outlays}} = \frac{3357}{6210} = 0.54$$

$$G_e = \frac{6210 - 3357}{6210} = 0.46$$

Equation (5.17') (HSTF)

δ_H is the share of resource tax revenue allocated to the Heritage Fund. It is set by provincial statute to be 0.30.

Equation (5.18') (Savings out of domestic income)

θ_{sxi} denotes the share of savings derived from the income of factor x in the ith sector. This parameter is assigned the following value:

$\theta SL = 0.1$ $\theta SH = 0.6$ (government saving)

Sector	θSR_i	θSK_i
1	0.05	0.05
2	0.01	0.01
3	--	0.01
4	--	0.01
5	0.08	0.08

These parameters were determined using Alberta (1978b, Table 5). For 1976 provincial saving is distributed as follows:

	($ millions)
Personal	702
Government saving	1364
HSTF	1993
Corporate	1683
Total	5742

$$\theta SL = \frac{702}{5742} = 0.122$$

$$\theta SH = \frac{1364 + 1993}{5742} = 0.585$$

$$\theta corporate = \frac{1683}{5742} = 0.293$$

Corporate saving was then prorated by the distribution of gross income by sector (YR_i and YS_i in equation (5.16')). The share of resource land in before-tax income is 0.2 ($\sum_{i=1,2,5} YR_i$) while the share of capital is 0.233 ($= \sum_{i=1}^{5} YK_i$). Netting out labour's share of income we have

resource land's share as $.2/(.2 + .233) = .462$

and capital's share as $.233/(.2 + .233) = .538$.

Corporate saving's share can be prorated between land and capital:

$\theta Land = .462(.293) = .135$

$\theta Capital = .538(.293) = .158$

Land and capital's share of saving can be distributed over individual sectors following a similar procedure of prorating. This time capital's share of saving will be prorated by the share of each sector's capital in capital's total share of income. A similar procedure would be followed for land.

These θsxi, as calculated here, are in fact shares of after-tax saving derived from the income of factor x in the ith sector. It was therefore unnecessary to determine the $\theta stxi$ in equation (5.18') which are supposed to

represent the reduction in the share of saving due to taxes on factor incomes in the ith sector.

Equation (5.19') (disposable income)

The parameters in equation (5.19') include the share of saving in income and the share of disposable income in income. Total saving in Alberta in 1976 is $5742 million (Alberta, 1978b, Table 5). Alberta's gross domestic product in that same year was $19,434 million (Alberta, 1978a, Table 46). Thus S/Y equals 0.29 while YD/Y equals (1 - 0.29) or 0.71.

Equation (5.20') (investment in capital and land assets)

θ_{Ixi} is the share of the xth financial asset of the ith sector in aggregate investment expenditure. To calculate values for θ_{Ixi}, it was first decided to assme a value of 0.4 for the share of total investment accounted for by capital goods (θ_{Ik}) and 0.6 for the share accounted for by land (θ_{IR}). The sectoral values for θ_{IR} were also assumed arbitrarily as follows:

Sector	θ_{IRi}
1	0.2
2	0.1
5	0.3

An attempt was made to calculated reasonable values for θ_{Ik} which are listed as follows:

Sector	θ_{Iki}
1	0.088
2	0.036
3	0.016
4	0.012
5	0.248

These parameters were calculated using data pertaining to the distribution of capital stock among sectors. This data is provided in Alberta (1978b, Table 13). For 1976, mid year net capital stock excluding housing is shown to be as follows:

	millions $	
Agriculture	4361	4391 Sector 2
Forestry	30	
Mining	10359	10359 Sector 1
Manufacturing	2978	2978 Sectors 3 and 4
Construction	379	
Transportation	5911	
Utilities	3217	16291 Sector 5
Trade	1220	
Finance	1511	
Services	4053	
Public Admin.	7443	7443 Sector 6
Total	41462	

To divide the value for manufacturing ($2978 million) into its component sectors (three and four), value-added data for Alberta's manufacturing industries were employed. In the Alberta (1978a, Table 81) value-added in manufacturing industries are provided for the year 1976. Those industries classified as primary (sector three) industries are listed as follows:

	($ '000)
Food and beverages	398,178
Wood	112,905
Furniture and fixtures	28,955

	($ '000)
Paper and allied industries	59,915
Non-metallic mineral products industries	177,452
Petroleum and coal products industries	109,431
Chemical and chemical products industries	152,660
	1,039,496
Total all industries	1,744,554

Share of primary (sector three) industries in value added $= \frac{1,039,496}{1,744,554} = 0.60$

Share of secondary (sector four) industries in value added $= 1 - 0.60 = 0.40$

Prorating capital stock in manufacturing by these shares, we have .6(2978) = $1786.8 million for the mid year capital stock in sector three and .4(2978) = $1191.2 million for sector four.

To estimate capital stock in housing, the assumption was made that the portion of capital stock in residential construction in 1976 equalled the portion of investment in residential construction in that same year.

	($ millions)
Alberta's gross fixed capital formation (1976) (Alberta Economic Accounts, 1978, Table 5)	7230
Alberta's residential construction in 1976 (Alberta Statistical Review, 1978, Table 84)	1700

Residential construction as a portion of non residential construction

$$= \frac{1700}{(7230 - 1700)} = 0.31$$

The service sector's mid year capital stock exclusive of housing was previously given as $16,291 million. An estimate of the service sector's mid year capital stock inclusive of housing is

$(.31 \times 16{,}291) + 16{,}291 = 21{,}341$

Thus, our mid year sectoral distribution of capital stock in Alberta is estimated to be as follows:

Sector	$ million	% of total
1	10,359	22
2	4,391	9
3	1,786.8	4
4	1,191.2	3
5	28,784.2	62

These percentages are then multiplied by 0.4 (the assumed share of investment accounted for by capital goods) in order to obtain the θIK_i. Public administration has been added here into the service sector in order to accomodate our assumption in the model that the government sector employs only labour and intermediate goods to produce output.

Equation (5.21') (savings = investment)

The new parameters that are required in this equation are the share of total saving arising fro foreign sources (δSF) and the share arising from domestic sources (δSD). δSF was calculated from the capital account data provided in the Alberta (1978b, Table 5). In 1976, Alberta's consolidated capital account totalled $6646 million. Included in this total is an outflow of capital from Alberta of $1462 million (includes the residual) representing a surplus on current transactions with non-residents. The contribution of foreign savings is therefore set at -$1462 or -.22 percent of the total capital account. It follows that domestic saving must account for 1.22 percent of investment.

Equation (5.22') (balance of payments)

In the balance of payments equation, BP_1, BP_2, BP_3 and BP_4 represent the shares of these sector's output in the balance of payments. The shares were calculated using the only detailed industrial data available for imports and exports to and from Alberta. This data is provided by the Alberta Bureau of Statistics in a form which gives an industrial breakdown (percentages only) of Alberta's imports and exports in 1974. In order to determine net exports from each sector, the thirty-five industries used in the Alberta Bureau of Statistics classification had to be aggregated into the four relevant sectors in our model. This was done by first estimating the actual dollar value of exports and imports of the thirty-five industries. Values for total Alberta exports and imports for 1974 were taken from the Alberta Economic Accounts, 1978, Table 2. These values (exports: \$7814 million; imports: -\$5128 million) were multiplied by the percentages supplied by the Alberta Bureau of Statistics which had first been adjusted to net out dummy industries, transportation margins, indirect taxes, etc. (components 36 to 46). The results of these calculations indicate the following values for net exports (exports minus imports):

Sector	Net exports (\$ millions)	Share in net exports
1	4185	1.5
2	848	0.3
3	426	0.15
4	-2673	-0.95

In order to be consistent with the statistics employed previously, particularly those used for the share of foreign saving in total saving in equation (5.16'), it was necessary to estimate 1976 data from this 1974 data. This was done

simply by prorating the 1976 total for Alberta net exports by the 1974 sectoral net export shares.

	($ millions)
Total exports from Alberta (1976)	9758
Total imports to Alberta (1976)	- 6562
Net exports	3196

Source: Alberta (1978b, Table 2).

Estimated 1976 net exports prorated by 1974 shares:

Sector		($ millions)	
1	1.5(3196)	4794	BP_1
2	0.3(3196)	958.8	BP_2
3	(0.15)(3196)	479.4	BP_3
4	(-.95)(3196)	-3036.2	BP_4

The share of foreign savings in the balance of payments (BPFSAV) was taken to be the -$1462 million outflow of capital which was used in determining δSF in equation (5.21'). The share of short-term capital flows in the balance of payments is taken to be an accomodating item to balance the balance of payments. Thus BPSTC is equal to - (3196-1462) which equals -1734.

The parameter v in equation (5.22') represents the share of sector four which consists of imported capital goods. It is specified as 0.28.